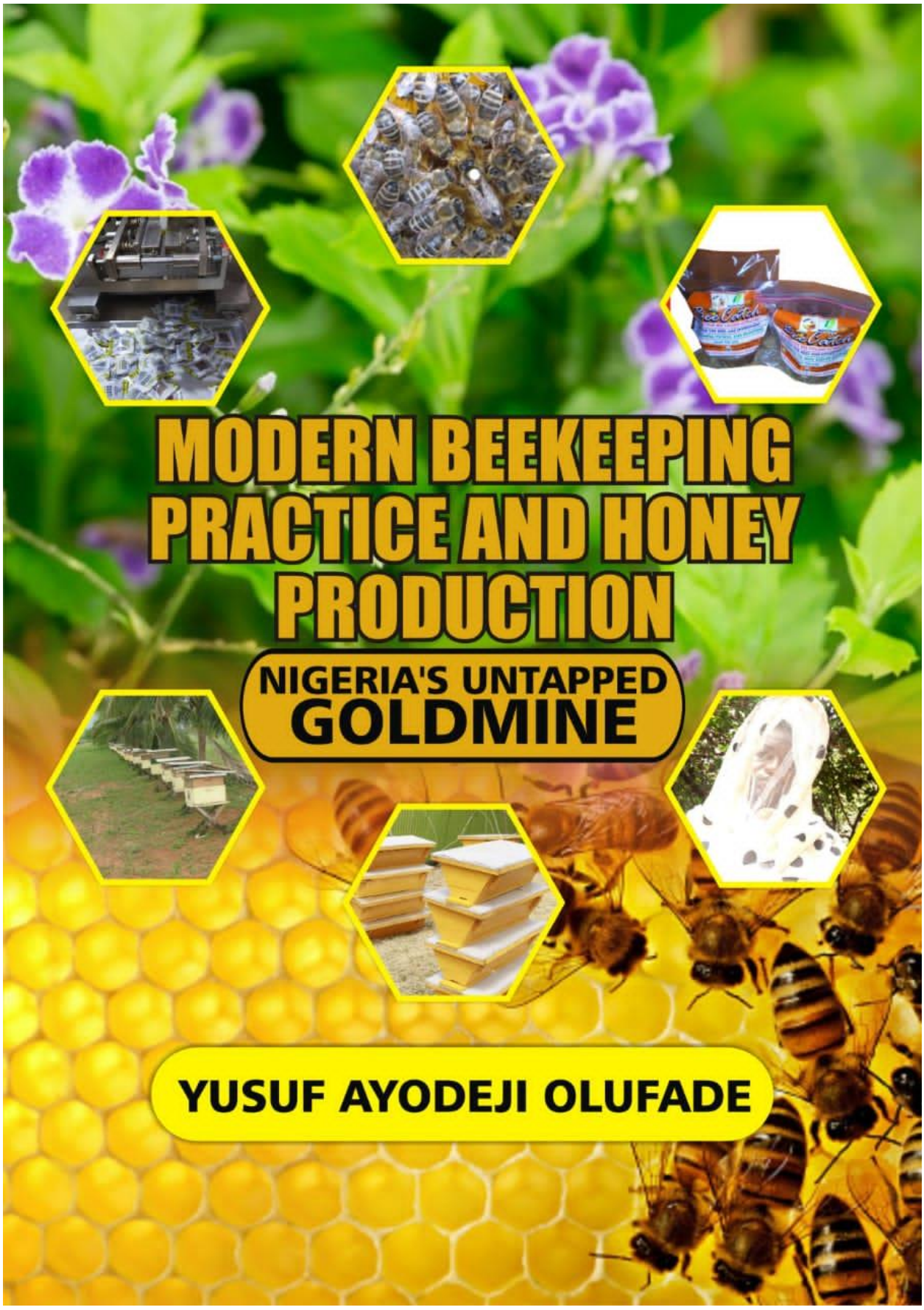
MODERN BEEKEEPING PRACTICE AND HONEY PRODUCTION
NIGERIA'S UNTAPPED GOLDMINE
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PREFACE

Communal beekeeping initiatives can be up-scaled from a hobby to commercial enterprises that are sustainable and protect the environment. This came after the realization that many natural forests were being destroyed across Nigeria for a number of reasons, but a major one being charcoal trade as communities were trying to earn a living. Many communities have also been cutting down trees to access wild bee nests for their honey (honey hunting), depleting the indigenous tree population. This is an unsustainable practice, exposing forests to wildfires which do serious damage to ecosystems, hence one of the reasons for writing this book as efforts to educate, train and capacitate Nigerians with modern beekeeping practices thereby raising awareness about the country's untapped goldmine.

There is no gainsaying that when people hear of bees, they are engulfed with maelstrom of fear; but anywhere beekeepers see the honeybees, they are filled with whirlwind of excitement. Therefore, an ordinary man sees the bees as harmful while the beekeepers see it as a blessing to humanity. So, perception is key. Being a huge blessing to humanity, there are quite a number of lessons to be learnt from these wonderful creatures called the 'golden insects'. From the camaraderie I have shared with the bees over the years, bees are wonderful insects in not just being self-sacrificing, loving one another but also being a close family having the lines of communication always open.

There is quite a raft of myths sparked around the honeybees over the years in Nigeria. Chief amongst them is that the honey is their excreta. Honey is their stored food collected from various sources especially from flowers of plants. They keep sharp eye on flowers, analyzing the distance, direction and orientation of each and sharing the analyzed information with one another. You can take a legend out of a game, but you can't take the game out of the legend. They are legendary in gathering and sharing (of anything whether food or information).

This book will help you to start and continue to be a beekeeper. It offers advice in a very practical manner, with step-by-step guidance at each stage of the way. The advice and information it contains are based on general beekeeping knowledge, my own experiences, my successes in beekeeping and, more importantly, my frequent early failings.

No book on beekeeping can cover everything about such a vast subject, and so a decision was taken to steer the reader towards the practical rather than the theoretical side of the subject. It is hoped that, by doing so, this book should help to get you started. You can pick up the more theoretical aspects from specialist books and beekeeping journals and papers – the important thing now is to begin to explore the exciting world of beekeeping which is largely untapped in Nigeria.

This book will also let government at all levels, corporate bodies and Non-Governmental Organizations to know the most sustainable and workable business model for commercial scale modern beekeeping in Nigeria based on my thorough research and analyses.

DEDICATION

This book is dedicated to my parents- Mr. R.A. Olufade and Mrs. F.A. Olufade. “My Lord, have mercy upon them as they brought me up (and supported me).”

ACKNOWLEDGEMENT

I am profoundly grateful to the Lord of universe. The mighty one whose authority can never be challenged. He neither sleeps nor slumbers; neither does He begets nor was He begotten.

A very warm appreciation goes to my Treasure, my wife of dignified status who is armoured with enviable cloak of modesty, patience, tolerance and understanding. My appreciation to her is eternal. And to my lovely daughters, thanks for being patient with daddy.

My SIBLINGS are **S**imply **I**ncredibly **B**enevolent **L**oving **I**ndividuals **N**urturing **G**odly **S**ouls. I am highly indebted to them all. Thanks for always being there for me.

Worthy of mention is Mr. AbdulKabir Olufade- a wonderful human being whose DNA is out of this world; a quintessential personage, rare gem of real stock. My load of thanks goes to him.

I am highly indebted to Alfa Kazim Yusuf who like the honeybees, is self sacrificing. He was practically killing (i.e. cutting down) his family expenses in other to accommodate mine in a strange land full of uncertainties.

One man that is always ready to be there for me is Imam Abubakar Aliyu El-Gambari. A selfless charismatic leader who longs to always see me happy even at the expense of his. Always accentuating and repeating a reminder note of regular supplication to Allah. *Gaskia*, I can't thank him enough!

I'll forever be grateful to AIG Ibrahim Kaoje for his pheromonic communication style that has always helped in mopping out tension in me.

I must not forget my sweet brother (i.e. Bro. Mustapha Zakariyya *Al-Fulani*) who wrapped me up with accommodation in a strange land. The warmth I received charged my cognitive faculty during those chilled nights of harmattan.

Immense support and words of hope I received from my brother from another mother, Bro. Imran Taiwo (Elejire) is worthy of mention. He is indeed a very hardworking reconnaissance drone with precise altruistic missiles. I thank him a great deal.

CHAPTER ONE

BEEKEEPING PRACTICE

The practice of beekeeping otherwise known as ***Apiculture*** is the maintenance of honeybees and hives for the purpose of producing honey, bee wax, and other bee products; crop pollination services, and the sale of bee attractants or bees to other beekeepers. It is simply the domestication of bees, the maintenance of their colonies, commonly in man-made hives, by humans.

Beekeeping as an Art

Although beekeeping certainly has its scientific aspects (both social science and biological sciences), it is really as much an Art as it is a Science. For lovers of architectural/artistic designs, or lovers of sounds or colors, or lovers of systemic organized drama; beekeeping is a vocation to explore because it literally becomes a pleasure while working. The honey bees itself is Mother Nature's very own work of art.

Humans are drawn to bees. Unlike most familiar, flying insects such as mosquitoes or houseflies — those pests we impulsively dodge or swat — bees are likely to give us pause. Their appearance, buzz, wax, honey, and the collective productivity of the colony itself, generates reverence and awe, even with the threat of a sting. It is not surprising that poets and visual artists are attracted to both the architecture of the hive and the aesthetics of their labor (Steiner, 1998; Brown, 2006).

One of the most amazing distinctions about bees is the architectural hexagonal comb cells they make. Watching a large group of bees building honeycombs, one assumes that the end result must be total confusion. There seems little chance that these insects, which all seem to be acting independently of one another, could ever produce such imposing structures. Contrary to appearances, however, bees work together in building the comb, in total harmony and in an exceedingly ordered manner. In fact, although they start from different points, they all build cells of exactly the same size. The joints where they meet in the middle are invisible, and there is never any error in the angles of their hexagons.

Bees build combs only when there is a need in the hive. They build these for shelter, storing food and raising larvae, and every aspect of the combs is regulated. Each is double-sided, for instance, with cells sharing a common base; and each comb face can have hundreds or even thousands of cells, produced in an ordered manner to be filled with honey, pollen and eggs. In fact, there is a most regular structure in the combs, so that the honey and larvae never become intermingled.

Honeybees buzzing and dancing can be very fascinating and sufficiently artistic. Bees "describe" the location of a distant place by dancing. All the information that other bees need to find the food source—its distance from the hive, its direction, productivity—is encoded in this dance. Once it locates a new food source, the bee returns to the hive and starts repeating specific movements in such a way as to attract the other bees' attention.

A lover of drama will almost get carried away while observing the honeybees as he/she relish their systemic organized drama. From the way they communicate, to taking care of young ones, attacking intruders and embalming them, self-sacrificing and dyeing for the colony to subsist. The defense of the hive is a major responsibility that concerns the entire colony—one that the guard bees fulfill even at the cost of their own lives. Every bee in the hive behaves in the same way, and when the time comes, it assumes the role of sentry, protecting the colony at the risk of its own life.

Beekeeping is an art. It's artistic in the sense that science alone will not guarantee a successful beekeeper. Experience, anticipation, and an understanding of various external factors outside one's control are required and just as important as knowledge of bee science, botany, and modern agriculture. The art of successfully caring for bees is in understanding this balance and applying what you know to each unique hive and environment.

Beekeeping as a Science

As earlier posited, there are two angles to this: the social science and biological science. The social science aspect cuts across bee sociology and ethology.

Individual bees can be more or less socially interactive, perform tasks with different levels of activity and exhibit aggressive tendencies. In highly integrated eusocial insect structures, the

concept of personality can be extended to the colony level. Different colonies are known to have different temperaments and activity levels, showing variation in foraging intensity, defensive response, comb repair and undertaking. With natural selection playing a major role at the colony level, different colony personalities may lead to differences in reproductive success and survival. Colonies that are collectively more active while foraging gain access to a greater amount of the resources necessary to maintain the hive structure and feed individuals, resulting in a more productive hive.

The study of individual and collective personality in honeybees is not only important from a scientific perspective; it also gives us a more sophisticated understanding of how colony temperament and performance might be threatened by environmental and man-made changes, helping us to protect bees and hopefully prevent their further decline.

As for the biological science aspect, I will like to start with the queen.

A brief look at the beehive reveals that the workers take particular care of one bee, far larger than themselves. The other bees supply all these bee's needs, such as feeding, cleaning and security. Although any hive contains tens of thousands of bees, there is only one queen, whose longevity is of vital importance to the entire hive. She ensures the continuity of the colony. In addition, discipline in the colony is ensured by substances she releases. Throughout her life, the queen does nothing but lay eggs. She is always inside the hive, never leaves it, and lays eggs every day.

If you watch bees gathering food in a field full of various flowers, something very interesting may catch your attention. A bee always moves between flowers of one particular species. It pays no attention to other kinds of flower as it flies from one to another. Bees sometimes spend days visiting flowers of the same species, which behavior benefits both them and the flowers. A bee that lands on a flower for the first time and is unfamiliar with that flower's structure must spend a considerable time in order to find a single drop of nectar. But after landing on the same kind of flower five or six times, the bee begins to gain speed and competence, since it is able to attain its aim more easily. This also benefits the flowers, because bees' preference for a single species permits rapid and efficient fertilization. Pollen from one flower cannot fertilize other species, and flowers are fertilized only by the bees traveling between the members of the same species. Bees

make use of scent in order to find flowers of the same species. Bees leave a scent on flowers they have visited previously and from which they've collected nectar or pollen. This way, subsequent bees do not waste time and energy on "harvested" flowers.

The population-planning method implemented in beehives is the most rational option. When the population of the bees rises too high, the bees set about lowering it—but not by killing the larvae and pupae. They adopt a very rational solution, beneficial from all points of view. When the population of a hive rises, one portion of the bees leave in a group, together with the queen and begin looking for a new place to settle. This practice, known as swarming, allows the surplus bees to establish a brand-new colony. The old queen, who does possess the ability to lay eggs, leaves the hive long before the new one emerges. This situation, which may appear very confused at first glance, is resolved by the workers with perfect timing. At the same time that the workers begin to construct new queen cells, they oblige the old queen to abandon the egg-laying process, because the time to migrate has come and necessary preparations must be made.

Honeybees are strongly affected by temperature changes. Processes such as the production of wax and honey all take place at a specific temperature. Those most affected by changes in the hive temperature are the young, and for that reason, great care is taken over the temperature in the brood cells. Bees engage in various activities in order to stabilize the temperature in the hive regardless of the temperature changes over the course of the day. In the early morning, for instance, when air temperatures are coldest, the workers throng together around the combs and warm the eggs with their own body heat. As the day goes on and air temperatures start to rise, this mass of bees gradually disperses. If the temperature continues to rise, the bees start to beat their wings in order to ventilate this region and lower the temperature. They seek to lower the temperature by directing the air current to the hive entrance and toward the combs.

On very hot days, bees use a rather stronger means of cooling. When the temperature in the hive rises to a severe level, rather than bringing pollen or nectar the foraging bees bring drops of water they've collected from various sources and sprinkle these over the brood cells. They then set up an air current with their wings to evaporate this water. Via this method, the temperature soon returns to its previous level. Bees achieve temperature balance in the hive by a number of

methods. In the event that the hive temperature rises, the bees beat their wings to set up a current to cool it off again.

Environmental sciences have clearly shown that there is no negative impact of beekeeping on the environment. Bees are important component of a healthy environment and help farmers pollinate their crops. They also produce other commodities as well, including beeswax, propolis, pollen pellets, royal jelly, and bee venom. While royal jelly is often sold to other beekeepers to help produce more queen bees, the other products listed above have many uses outside of the bee-realm. For example, honey, beeswax, propolis, and bee venom have all been used by medical professionals. Honey has been used to treat allergies, digestive problems, and even wounds. Today it is often found in cough drops, along with propolis or "bee glue", to treat coughs and sore throats. Beeswax is a common ingredient in pills, creams, and salves and is even a main ingredient in surgical bone wax. Lastly, bee venom has been used to treat arthritis and provide pain relief to those who are not allergic to it due to its anti-inflammatory properties.

To implement beekeeping projects, understanding the biology, physiology, ecology and ethology (i.e. bees' communication, defense, aggression, mating, imprinting, fixed action patterns and releasers, and swarming in their natural conditions) of your bees is essential.

Beekeeping as a Business

From my experience and robust stint in modern beekeeping in Nigeria, a business opportunity in modern beekeeping is multipronged; and two or more can be combined for continuous and sustainable income flow.

An average Nigerian beekeeper with the requisite skills, knowledge of modern beekeeping, and the right attitude towards the practice but limited sophisticated equipment can easily make cool profit from selling honey, other bee products (especially bee wax), beekeeping equipment, bee attractants. Other extraneous income sources *inter alia* are rendering services like apiary maintenance/management for investors, pollination services (on orchards or nurseries) for fruit or vegetable farmers and bee sting therapy.

It should however be noted at this juncture, that a beekeeper without adequate knowledge about the nitty-gritty of apitherapy (especially bee sting therapy) should not delve into this area out of greed, so as to avoid collateral damage and accompanying liabilities. I will even suggest that an expert bee sting therapist should commit his/her clients to sign terms and conditions before sting administration in other to avoid consequent litigations if things go wrong.

How much do bee farmers make a year in Nigeria?

Experience has shown that in the first year from honey alone, you can only get between 60% to 80% of your initial investment because of the bee gestation period of 8 months. Meanwhile, from the second year up till the 10^{th} year (since the hives have a useful life of 10 years if well managed, hence no course for yearly replacement); you will be getting between 160% to 200% of your initial investment as net profit per annum with an infinitesimal recurrent expenditure. You can also generate additional income by making items from beeswax.

Is Business of beekeeping hard?

A colony of bees can be fragile. Although the work is not physically hard, attention to detail is important. You must monitor your colony and react quickly to any signs of trouble. An entire colony can be wiped out by predators or disease. Hence, the need to always be in touch with an experienced beekeeper.

Beekeeping and Other Agricultural Enterprise

Comparing with other agricultural activities, beekeeping has many relative advantages because of the following reasons:

a) Unlike cultivation of crops and animal husbandry, beekeeping does not disturb the ecological balances of an area. Instead, it is an environmentally friendly activity.
b) Beekeeping does not compete for resources with other agricultural activities. Hence, it can be integrated with annual and perennial crop production, animal husbandry and natural resource conservation.

c) Since beekeeping is light work, it can be done by women, aged men and persons with disabilities. Moreover, since it is less labor intensive, it can be done as part time and side line activity.

d) Beekeeping assists to utilize resources like pollen and nectar which otherwise are wasted. Man cannot utilize these resources without bees.

e) Beekeeping can be run in areas which are not suitable for cultivation of crops and animal husbandry such as hills and escarpments.

f) Bee products like honey and beeswax are not perishable and can be transported and stored for longer periods and their prices do not fluctuate very much over seasons.

g) Beekeeping can be run with little land, because bees can forage in any place around their foraging distances and it is useful for intensification of land and also in areas where there are shortage of land.

h) Beekeeping is useful in improving the quality and quantity of crop yields and contributes for the maintaining biodiversity through efficient pollination services of honeybees.

MAKING A CAREER IN BEEKEEPING

Hobby Beekeepers

Beekeeping as a hobby is large in scope but little known about. Some beekeepers in Nigeria – in fact mostly retirees – remain hobbyists, and they enjoy their beekeeping immensely to their dying day. Because they have time, they notice things, and many an idea put to commercial use in beekeeping has been dreamt up by a hobbyist.

Hobbyists are also experimenters. While the commercial operator simply hasn't got the time to experiment, the hobbyist will try things out and buy fangled device or material they don't need but do want. They will use them and either debunk them or tell the world how well they work. Hobbyists are as essential to the beekeeping world as the largest of honey farmers.

Running your Own Beekeeping Business

You can approach running your own beekeeping business from two angles. First, you could gradually build up the number of hives you have as a hobbyist, gathering experience all the time, until you have sufficient hives to earn some side-money from.

This is usually where some beekeepers stop, but some go on and suddenly find that not only are they earning money but also they now have the experience and contacts to earn more, if only they had the time. This is when you must decide whether to chuck in the safety of your main job at the office or take up the undoubtedly lucrative but demanding job of working for yourself in an activity that is dependent on the weather and nature, like most farming activities.

It has been done and there are many medium to large beekeeping companies that have been through this phase of development successfully.

The second way of starting your own business is to have a seasoned beekeeper as mentor. He will train you and help you setup your beekeeping project from small scale (100 to 200 hives) to medium, then to large scale commercial bee farm so that you gain experience as you scale up to be a commercial beekeeping company through the build-up process. You will already have experience and you will have the advantage of having seen different ideas and systems in action with various production loops. This is a great way to start in beekeeping and has many advantages over the build-up method, not least the fact that you are already aware of all the costs involved and the experience levels required to run large numbers of commercial hives.

Beekeeping for People Living With Disability (PLWD)

In many things, people living with disability should always be considered. I firmly believe in the inclusiveness of the PLWD in practicing and enjoying beekeeping. Obviously this would depend on the extent of their disability but, for those in wheelchairs, for example, the hives could be specially designed for accessibility. May be something like a short Kenyan top bar hive with a hinged lid, so that even in wheelchair, one could manage the bees.

I believe government and other stakeholders should encourage the PLWD in Nigeria because beekeeping business is less stressful, time flexible and profitable.

Scientific Careers

A career in beekeeping doesn't necessarily mean being a beekeeper. The world of science is open to those who are suitably qualified, and the number of research possibilities is endless. We know comparatively little about the bees which we use to compare with, say, cattle or sheep, and the whole idea of insects as social animals can teach us a great deal.

There are thousands of questions about honeybees and their products that would provide valid and useful research opportunities; the drone congregation areas, mimicking pheromones for colony stability and pest control and many more.

Entry to research is usually through a Bachelors degree in Science and then moving on to postgraduate study. A talk with your university adviser and a basic Internet search should show which research institutes are open to supervising this type of research, and don't forget that government laboratories generally require scientists at this level.

I first took honours in the Agricultural Economics, and I later had to cross to Plant Science (where I could study entomology) on a postgraduate research programme, albeit at the moment, I am a seasoned professional beekeeper in the business of beekeeping. So my advice is if you want to etch out a career out of beekeeping research, go for it, and the earlier the better. We need you.

CHAPTER TWO

BEEKEEPING IN NIGERIA

Beekeeping is an activity that needs to be developed, as there is a great scope in broadening its base in Nigeria. The country possesses enormous potential to transform beekeeping into a productive industry. As it can play a very vital role in increasing rural income as well as contributing to increased export earning, its role in bio-diversity conservation, the usefulness of its hive products as raw materials for local industries which include those of baking. Bakers buy large amount of honey to use in crackers, cookies and other baked goods. They are also used for confectionary, cosmetics, pharmaceuticals etc in which we are presently importing such material as bee wax and propolis. In this way, beekeeping could also save our scarce foreign exchange export from crude oil as major products.

Bee products are generally produced on a small scale in the country, this could be attributed to people's attitude of not really taking beekeeping as a form of vocation, which makes them to be naive of it numerous benefits, thus making the rate of expansion of apiculture industry to be relatively low compared to other fields of agriculture in Nigeria. This low expansion rate could be related to gross unawareness of the use and value of honey and other hive products, poor and ineffective collection, processing and preservation method as well as poor handling which results to product of inferior quality. Nigeria is one of the countries which practice beekeeping but this has not resulted into any commercial marketing. This can be attributed to gross underutilization and inadequate exploitation of beekeeping potential in the country.

Beekeeping in Nigeria has a long history of rise and fall. Honeybee seems to have a great economic potential for entrepreneurs in Nigeria. Bees are naturally ranged in semi-arid lands and Savannah. Therefore, these bees are used to extreme temperatures. This does not mean bees don't do well in southern part of the country. The productivity and the yield are not as much as what obtains in the north because the latter has lesser rainfall and lesser bee wax infestation. Nonetheless, what is the best for them? Traditional or modern process of gathering?

Traditional Beekeeping

What is known to a lot of people of honey source in Nigeria is through *honey hunting*. This is not beekeeping in any way. Honey hunting is a usual practice of the locals whereby they break into the wild bee colonies in hollow of trees or rock crevices and burn them down at night when the bees are less active; thereby killing the bees in the process. This practice is not sustainable at all, and detrimental to the environment, hence it's condemned in outright terms and should be discouraged.

Beekeeping is not new in Nigeria. It has been practiced from time immemorial, especially in the core northern part of the country. Traditionally common are grass hives (made from dry millet stem, tethered together with plant fibre, and cow dung) and clay hives. Therefore, grass and mud have played major roles in providing material for beehive construction.

Fig 1: Lateral View of Grass Hive

Fig 2: Inner View of Clay Hive

Even though traditional hives are cheap and their materials are easily sourced, they have very short useful life, and they cannot be easily manipulated because bees fix combs to the hive body. Combs cannot be inspected at all, and detached combs cannot be easily replaced.

While honey hunting practices have detrimental effects on the environment, traditional beekeeping on the other hand destroys honey bee population (destroying the bee brood and

combs), lowers quality and quantity of hive products, reduced economic gains of the farming community. These crude/traditional methods are a threat to sustainability of bee business.

However, with modern skills and practices in production and processing, many more and higher quality products are harvested from the hive. The modern box/framed hives are designed to make inspection and harvesting of products easier since the bars/frames and hives are not attached by wax or propolis. Equally, the use of complete bee kit reduces bee stings on the farmer thereby allowing him to focus and complete his work (during inspection or harvesting) without fear of being stung.

Modern Beekeeping

Modern beekeeping is more profitable in terms of yield and profit from sales. Modern beekeeping generates more income than traditional bee farming despite its production cost.

The inter-comb distance discovery – the way in which honeybees build their combs with just enough distance between them to allow a couple of bees to pass through back-to-back sparked up what we now know as modern beekeeping. According to FAO (2021), Lorenzo Lorraine Langstroth (1810–1895) devoted his entire life to studying bees and devised a hive with removable combs, building on various other models. In 1851, he discovered “bee space”, which is the precise gap (9.5 mm) within a hive or nest that bees never fill with wax or propolis. When a gap of this size is left between frames or bars, bees do not build honeycombs or bridges and the frame is mobile, obviating the need to destroy honeycombs to extract products. Langstroth is generally recognized as the inventor of the modern beehive. He perfected and standardized the measurements, assembling them into a hive model that forms the basis of today’s most widely used hives.

Therefore, movable-frame hives used in modern beekeeping are the result of chronological evolution of beekeeping from local-style hives. In short, movable-frame hives can be opened, allowing beekeepers to see what is happening inside. As such, there is no need for burning down colony or using insecticide, and they can avoid destroying honeycombs, as well as apply treatments more easily. It also allows the bees to multiply colonies. This results in increased

honey production and honey quality. They can also enable the provision of pollination services and the adoption of several beekeeping techniques.

Movable-frame hives not only provide a suitable home for bee colonies, but also facilitate the production and harvesting of bee products. The beekeeper can fix a colony in place, protecting it from harmful weather conditions or predators, allowing for closer health monitoring, and enabling easy storage and harvesting of bee products (such as by directing production towards nutritious products rather than reproduction).

However, movable-frame beekeeping needs a starting amount of money and resources which are not always available amongst rural populace. What is now referred to as modern technology is gaining momentum in many Nigerian beekeeping communities with the help of passionate beekeepers that are assisting them with beekeeping projects as a means of fighting extreme poverty and hunger. This has brought the establishment of commercial-level beekeeping initiatives, where proper modern beekeeping practices are followed to:

- multiply the colonies through colony-splitting;
- stimulating early colony growth;
- Swarm prevention or control;
- Prevention or control of pest infestation and diseases;
- increase honey output for commercial retailing;
- Provide movable colony stocks for pollination services.

Two movable-frame hives are commonly used in Africa: the Langstroth hive and the top-bar hive (e.g. Kenyan top-bar hive). The latter is the most commonly used because of the lower costs associated with construction and management of the hive and colonies. Langstroth technology is considerably expensive, pushing many communal beekeepers to opt for local-style hives and top-bar hives.

Langstroth also found that several communicating hive boxes can be stacked one above another, and that the queen can be confined to the lowest, or brood, chamber, by means of a queen excluder. In this way, the upper chambers (called supers) can be reached only by the workers,

and therefore contain only honey-comb. This made hive inspection and many other management practices possible, and turned the art of beekeeping into a full-scale industry.

Other bee enthusiasts have given their names to similar hives that are essentially modifications of the original Langstroth, and these frame hives are in general use throughout Europe, North America, Australia, parts of South America and Asia, as well as in some northern and southern African countries. For technical and economic reasons, however, most African countries, mainly in the tropics, are not yet in a position to use frame hives.

For most Nigerian beekeepers, the top-bar hive represents a satisfactory compromise, although it is admittedly less efficient and perhaps somewhat more difficult to use, especially for neophyte beekeepers.

Fig 3: Newly Placed Kenyan Top Bar Hive

Fig 4: Existing Kenyan Top Bar Hive

Fig 5: New Uninstalled Langstroth Hive

Fig 6: Existing Langstroth Hive

The Necessary Beekeeping Equipment

Hive – There are two types, the Langstroth and the Top-Bar. The Kenyan Top Bar Hive (KTBH) is most common in Nigeria. These are elongated boxes, containing top bars. The Top-Bar is a horizontal set up, which uses vertical bars. The bees make the comb and honey on the bars, which are pulled out from the top.

Smokers – They are used to puff smoke, to calm the bees when a beekeeper needs to access the hive. The smoke renders bees docile, so that the beekeeper can work undisturbed. What the smoke does is that it mixes with alarm pheromone initially released by the worker bees when the queen signals them of an impending intrusion. The smoke thereby mask their communication pathways, and the only thing left for the worker bees after minutes of puffing the smoke is to gather round their queen in a corner; hence making it easy for the beekeeper to work on the hive. No honeybee will ever allow a beekeeper to harvest its honey without a fight. The tropical honeybee is noted for its aggressiveness, and the beekeeper is warned not to conduct any brood control or harvest without using his smoker. The smoker has

two main parts. The container, which is a metallic can, big enough to carry enough dry material to last at least 40 minutes. The bellows section, which puffs air into the container to drive the smoke out of the can. The container is loaded with wood shavings, smoldering cow-dung or any dry material which provides white smoke. No oil or kerosene should be used in a smoker.

Hive Tool – Like a crowbar, it's used to separate the Langstroth hive boxes. The boxes can get stuck together from the honey drips. A hive tool may be necessary to pry up and remove the frames from the beehive. The Kenyan top-bar hive may not need a hive tool, but a knife instead.

A knife may be required to pry open top-bars or frames which are usually glued to the hive body by the bees. The knife is also useful for cutting a portion of the comb attached to the hive body, separating two combs joined together, and cutting out the honeycomb from the top-bar during the honey harvest. A knife can perform almost all the functions of the hive tool, but the hive tool cannot be used to cut bee combs as neatly as is required.

Uncapping Knife – To remove the waxy caps from the sealed combs. Bees lay honey in the combs and then seal each comb. This tool removes the tops without damaging the combs. You only need to use a serrated back and forth motions to cut the caps thereby picking the wax off the honey cells. Usually used for Langstroth hive technology.

Protective gear – The bee suit, plus veil, gloves and boots. Most traditional honey-tappers prefer to strip themselves naked than to wear clothes when harvesting honey at night, but the modern beekeeper is advised to acquire suitable protective clothes to keep the bees from reaching his flesh. Thus a bee suit, gloves, veil and a pair of boots should be acquired before the honey is harvested or any work involving the opening of the hive is undertaken. When working with bees during the daylight hours, light-coloured clothing (preferably white, yellow or green) should be worn. For night work, dark colours are better. The bee suit is sewn to cover all parts of the body except the head, hands and feet. Bee suits are worn to harvest honey and to control the brood nest during the daylight hours. The veil is the most

important. The beekeeper can easily make or purchase a straw hat (or any type of hat with a brim). Netting is sewn firmly around the hat and attached at the back by a piece of cloth. The veil protects the head, face and neck from attack. Some bee suits have the veil sewn together with it. Like the one in the picture. Bee stings on the hand or fingers are among the most painful, and the beekeeper is urged to acquire gloves to ensure that he works with little or no difficulty. A pair of long boots is also important to protect the feet from stings.

The brush or quill -Bees must sometimes be brushed gently into a hive. A brush with soft hairs is useful for this, but if the beekeeper can easily obtain a strong, large quill like an ostrich or turkey feather, there is no need to acquire a brush. The quill of a big bird is better than any artificial device for this purpose.

Honey Extraction equipment – A centrifugal honey extractor can be hand-cranked or motorized. They come in a variety of sizes, depending on how many frames they can hold. For beekeepers using Kenyan Top bar hives, it's appropriate to use a honey press.

Fig 7: Honey Press (in use)

Fig 8: Centrifugal Honey Extractor

CHAPTER THREE

BASIC PRINCIPLES NECESSARY FOR A SUSTAINABLE BEEKEEPING IN NIGERIA

Maintaining Good Beekeeping Practices (GBPs)

While beekeeping techniques may vary considerably depending on environment and production, there are some fundamentals that never change. According FAO (2021), Good Beekeeping Practices (GBPs) can be defined as "integrative activities that beekeepers apply for on-apiary production to attain optimal health for humans, honeybees and the environment."

The GBPs is broad and includes but not limited to general apiary management, pest control and disease prevention, record keeping and hygiene.

Some of the GBPs Nigerian beekeepers must be watchful of includes the following *inter alia*:

- Carefully select apiary sites, avoiding windy, extremely humid or flood-prone areas. Avoid placing the apiary close to sources of pollutants (e.g. dumps, areas contaminated with pesticides, heavy metals) and if possible, place it in an area accessible to vehicles and with plenty of melliferous and polliniferous plants. You should also avoid siting your apiary on cattle grazing routes.
- Place the apiary in a firm and accessible area that allows for inspections during the rainy season
- Perform beehive maintenance when needed (do not leave your hives with openings or broken, to prevent robbing).
- Do not place beehives directly on the ground. They should be kept on stands with preventive measures against ants and rodents.
- Always use your protective gear when visiting honeybee colonies.
- Evaluate the melliferous and pollen capacity of the area, as well as the availability of water resources: install a number of hives that does not exceed the environmental capacity and choose locations with diverse sources that can support the bees throughout the season.

- Keep the apiary tidy and ensure apiary pathways and hive surroundings are free from tall grass or bushes. Periodical mowing of the grass can help reveal anomalous bee pest infestation and helps ward them off. It also helps prevent fire incidence especially during the harmattan season.
- Position hive's entrances such that the sun can reach them throughout the day, starting from the early morning. This enables the bees to start their activity as soon as possible, even on colder days.
- Install hives in a way that ensures optimal working conditions: avoid slopes and irregular or slippery soil, regulate the height of hive stands to ensure correct back posture while working; limit weight when lifting.
- Be careful about where you place the smoker when in use especially during the harmattan. Make sure you have water in hand for potential fires.
- Handle hives with great care. Hive disturbances caused by beekeepers, outsiders and/or other non-beekeepers should be kept to the absolute minimum.
- Buy bee attractants like BeeCatch© that are not only effective but also bee-friendly and environmentally friendly.

- Buy new bee colonies from local providers and only after thorough inspection for bee diseases
- Inspect hives carefully and periodically to monitor their health status
- Quickly isolate symptomatic beehives and remove infested combs after wax moth infestation. Burn and then bury infested combs; if fires are not allowed, bury them carefully, far away from any apiaries.
- Avoid unnecessary inspections, especially when it is cold or raining.

- Do not dispose of honeycomb, wax, propolis or other hive products near the apiary to prevent robbing and the possibility of persistent pathogens or larvae (e.g. *bacteria* spores, SHB, wax moth) spreading among colonies or to nearby apiaries. Only check on infected hives at the end of apiary inspection to prevent transmission to the healthy hives. Moreover, after inspecting an infected colony, disinfect the tools used (with bleach or other disinfectants).

- Raise the awareness of neighbours, farmers and others about the benefits of bees for pollination to create better agricultural practices, and consequently, better foraging and less toxicity for bees. This is a very effective preventive method and increases productivity. Occasionally, try to gift a little of your harvest to your neighbours.

There is growing evidence that the success of a sustainable beekeeping business is strongly associated with the application of GBPs, and the level of beekeeping education and disease control in particular.

Harvesting Process

The different indicators used by beekeepers for identifying honey ripening are: Smelling of honey around the hives, accumulation of bees around the entrance of hives, end of flowering season and assessing weight of the hive.

Smoke is blown into the opened hive so that the bees leave the honey combs. During harvesting, a beekeeper should select combs which contain ripe honey capped with a fine layer of beeswax. Uncapped combs, empty combs and combs containing pollen and broods (i.e. developing bees) should be left undisturbed. Bees should be brushed from the combs with a brush.

For a beekeeper using Langstroth hives, during honey harvesting, frames are removed from the boxes and uncapped with the fork. They are carefully arranged in transit containers and ferried to the processing room. Frames are then placed in an extractor and spun so that the honey can drip to the bottom of the tank, pass through a sieve and then collected into a storage tank. The tap on extractor is thereafter opened to allow pure honey flow out in containers and then packaged. The empty honeycombs are then returned to the hive. Since the combs are recycled, bees put effort into honey production rather than beeswax comb building. Hence, honey is rapidly stored by the bees and harvesting is more frequent since there is no need of making new combs; unlike the Kenyan top bar hives where ripe combs are cut in big buckets, then ferried to a processing room where it will be pressed to wax crumbs to extract the pure honey. Beekeepers using KTBH will have to wait for some months before another harvest because bees will have to start all over again with comb construction, then filling combs with honey.

Pests, Predators and Diseases of Bees

Like all living things, honeybees are attacked at all stages of their development by various enemies either directly as predators, or indirectly, by disturbing the life of the colony in various ways. The most important of these enemies are those that destroy the combs, the stores, the hive itself and some predators that attack foraging worker bees as they leave the hive. These include ants, wax moth, small hive beetle, termites, spider, lizard, birds and rodents. Pests and predators attack result in a considerable amount of honey loss and absconding of colonies. Some of the methods to prevent predators are keeping the apiary tidy and clean from under growth, avoiding throwing/scattering combs around the apiary site, application of ash around the hive stand, putting legs of the hive stand in small bowls containing used engine oil. Also by trapping the wax moth.

Disasters and diseases such as the colony collapse disorder, bee viruses, nosemosis, varroa mites, American Foulbrood, European Foulbrood, Amebiosis, Chalkbrood and Stonebrood are either non-existent or non-prevalent in Nigeria.

Herbicides and Insecticides Use

The chemicals applied to control weeds or insect pests of some crops by farmers usually causes a decline of up to one quarter of honey bee colony population in a particular apiary and reduction in honey flora resources, hence, productivity. The herbicides and insecticides are used particularly on cowpea and on vegetables such as tomato and cabbage. It is rarely applied to grain crops like maize except when there is a serious infestation of stalk borer and army worm.

Most Nigerian beekeepers are aware of the toxicity of insecticide and herbicides to bees. Several plants that are traditionally used as source of pollen and nectar in some areas in the country are declining from time to time due to application of herbicides. The use of these chemicals by farmers is acutely felt by beekeepers in the northern part of the country for obvious reason: more bee hive of crop farming activities than the south. Therefore in some places, honeybees are only seen midair when baiting a hive, they don’t move closer to the hive level. Even when the hive is placed on a tree branch, they only manage to come but won’t stay. A case study of where I served as a youth corps member in Gwoza, Borno state. Nonetheless, it’s advisable for beekeepers in the north to site their apiary in the remote zones where there is little or no disturbance of chemical use and herdsmen rampage.

Swarming Incidence and Its Management

Swarming is the natural means of propagation of honey bee colonies. A bee swarm is a cluster of bees containing a queen that has split from an established colony to start a new colony. All bees may swarm under certain conditions, but some races and strains are more inclined to swarm than others. In the southern part of the country, swarming mostly occurs from September to October. Meanwhile in the core north, it usually occurs between October and November. To smart beekeepers, swarming is advantageous to increase number of colony and to replace the non reproductive bee colonies.

When bees are preparing to swarm, they will always build queen cells. These are easily recognized by their large size, peanut-like appearance, and vertical position on the comb. Numerous queen cells on the lower parts of the combs or frames are called swarm cells. The bees may swarm one or two each day over a period of a week or more. Several conditions contribute to swarming. A crowded brood nest is one of the main causes. Another is the age and productiveness of the queen. Poor ventilation of the hive and weather conditions positively affecting the nectar flow may contribute to swarming.

Swarming can be prevented through colony splitting (artificial swarming), placing of supers or using spacious KTBH, installing swarm catchers during the swarming period, and considering heat reflecting features and ventilating features in hive construction.

Absconding and Reasons for Bees Absconding from Hives

Absconding is the term used when all the bees from a hive leave and desert the combs. Usually absconding occurs as a result of shortage of food, disturbance of the colony by pests, predators or even by the beekeeper. Other causes are bad management by the beekeepers such as excessive smoking during harvest and destructive ways of honey harvest. The beekeepers might be using unsuitable hives (either too small, too humid, or with a bad smell). Sitting hives in unsuitable places where there is too much shade, no shelter from rain or excessive heat. The rate of hive absconding is usually high, especially following harvest. Unfortunately, the honeybee species predominant in Nigeria which is *Apis mellifera* are usually prone to absconding with little disturbance. Hence, the need to prevent it by being proactive.

CHAPTER FOUR

INDUSTRY ANALYSIS

Beekeeping in Nigeria is a long-standing cultural agricultural practice. It has been exercised as a sideline activity by many of the rural farming communities for its honey and beeswax production that contributes to income generation. The role it plays in enhancing food security, poverty reduction and food production through pollination of crops has become substantial in the recent years. Frequent droughts coupled with environmental degradation have threatened the livelihood of this rural community for several decades. Among the main reasons for Nigerian agriculture's poor performance are shrinking farm size and subsistence farming, soil degradation, insufficient and variable rainfall, tenure insecurity, a weak agricultural research base and extension system, lack of financial services, imperfect agricultural markets, and poor infrastructure. However, regardless of other agricultural activities, bees survive in drought threatened areas and supplement the vulnerable communities with nutritious food, honey, and a source of income. Due to low productivity and low income from agriculture, it becomes necessary for farmers to resort to subsidiary enterprises such as beekeeping to augment their incomes and ensure and improve their livelihoods.

Therefore ranges of applications emerging from apiculture development are enormous and it is considered a major tool in combating food insecurity, while protecting the environment. Furthermore, the apiculture sub-sector is emerging as a strategic means of export diversification.

In fact, bees play a vital part in our natural ecosystems as they are responsible for the pollination of many fruit, nuts, vegetables and other species. According to UNEP (2010), 100 crop species provide 90% of food worldwide and of those 71 species are pollinated by bees. Extremely high mortality rates of bees in Europe, America and Asia, however, are putting the balance at risk. For instance, each decade between 1-10% of the world's biodiversity is lost, one of the factors being the decreasing bee population.

Africa is the only continent where the bee population remains stable and unaffected by emerging diseases. Yet, most African countries still import the majority of their honey for their domestic market. So why is the supply so low in Africa? Lack of knowledge about sustainable beekeeping

methods, low honey yields, complicated market access for beekeepers and over-exaggerated export regulations hinder the honey bucket from overflowing. There is also a marked supply deficit of honey given the fact that a great proportion of the honey in the market is from honey hunting and traditional hive.

Beekeeping as an agroforestry practice has not been given much attention in our country. There is increasing demand for honey in Nigeria. Honey has been identified by some Nigerian youths as a major cash income generating commodity; however the government is not yet seeing it as such. Nigeria has high potential in honey production. The country's potential for honey production, the variety of natural honey flavors associated with the country's diverse sources of bee forage, and Nigerian honey's desirable quality, such as being a multi floral honey have been widely recognized. The Nigerian honey is characterized by its diversity and distinctive structure due to the diversity of the geographical areas of mountains, plains and valleys, and small agricultural holdings of various plantations; in addition to the diversity of wild plants which are mostly medicinal that make the Nigerian honey known for its quality compared to the imported honey, which is mostly produced from one plant source, and mostly pasteurized.

The beekeeping, honey production and processing sub sector of agriculture in Nigeria is largely untapped and annual honey production is far below our endowed capacity. However, increasing interest in honey production among Nigerians on the internet shows that a number of people are increasingly picking interest in both honey production and honey processing.
The market potential is huge for sachet products and other bottled products, evidenced by what appears to be the unstoppable growth of honey demand in the country. The proliferation of honey merchants is increasing at rates which at one time were negligible.

Despite the growing awareness, not many are in the business of honey processing and honey value chain; hence honey processing is generally operated in a relatively small scale in Nigeria. Although there are wild bee hunters across the country, however only modern beekeepers can give pure and unadulterated honey because of the modern techniques of harvesting and the separation of brood combs from the honey combs.

In Nigeria and globally, honey and other produce of honeybees are used for a variety of purpose. From serving as food, to being used partly or wholly as both cosmetics and medicinal purposes. Adults and children are all considered to be in need of pure honey and its related products. In Nigeria, honey is in constant demand year rounds; and the industry is not challenged by the demand of honey.

So far, Nigeria has not succeeded in exploiting and even exploring its natural capacity for honey production, nor has it been able to fully benefit from its comparative advantage in the honey sector. Several factors have kept Nigerian honey production from reaching its full market potential. The key barriers to successfully expanding the Nigerian honey value chain primarily lay at the supply side of this commodity. Nigerian honey production is insufficient in terms of quantity as well as quality (due to issues of adulteration, traditional beekeeping and inadequate skills necessary for modern beekeeping).

Other serious problems facing beekeepers in order of their importance are late colonization of bee hives, shortage of bee forage, followed by absconding honey bee, insect pest infestation (such as ants and wax moth), inadequate modern beekeeping equipments, reduction of honey bee colony and lack of credit facilities.

Table 1: Honey production vs. Honey consumption in Nigeria

Year	Honey Production in Nigeria (Tonnes)	Honey Consumption In Nigeria (Tonnes)
2010	10,500	318,000
2011	10,000	317,000
2012	11,000	320,000
2013	12,000	325,000
2014	12,000	325,000
2015	13,500	343,000
2016	14,000	350,000
2017	15,000	370,000
2018	15,000	370,000
2019	15,000	370,000
2020	16,000	380,000

Source: FMARD (2021)

To meet the growing domestic demand as well as a likely profitable demand in the export markets, these supply-side issues need to be addressed.

The table above has shown that in 10 years (in focus), Nigeria can only produce between 3% to 4% of our yearly consumption. Therefore, we invariably imports about 95% of our yearly consumption to meet the demand-supply gap. Hence without gainsaying, the beekeeping sub-sector of the agricultural industry in Nigeria is still largely untapped; thus a golden opportunity to explore.

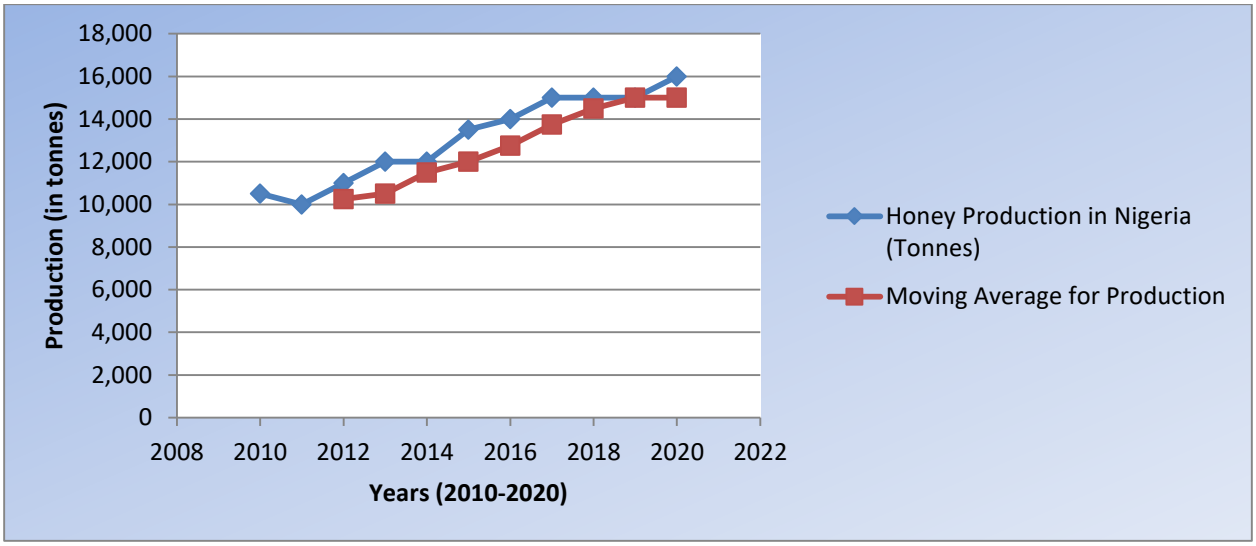


Fig. 9: Honey Production in Nigeria and its Moving Average from 2010 to 2020

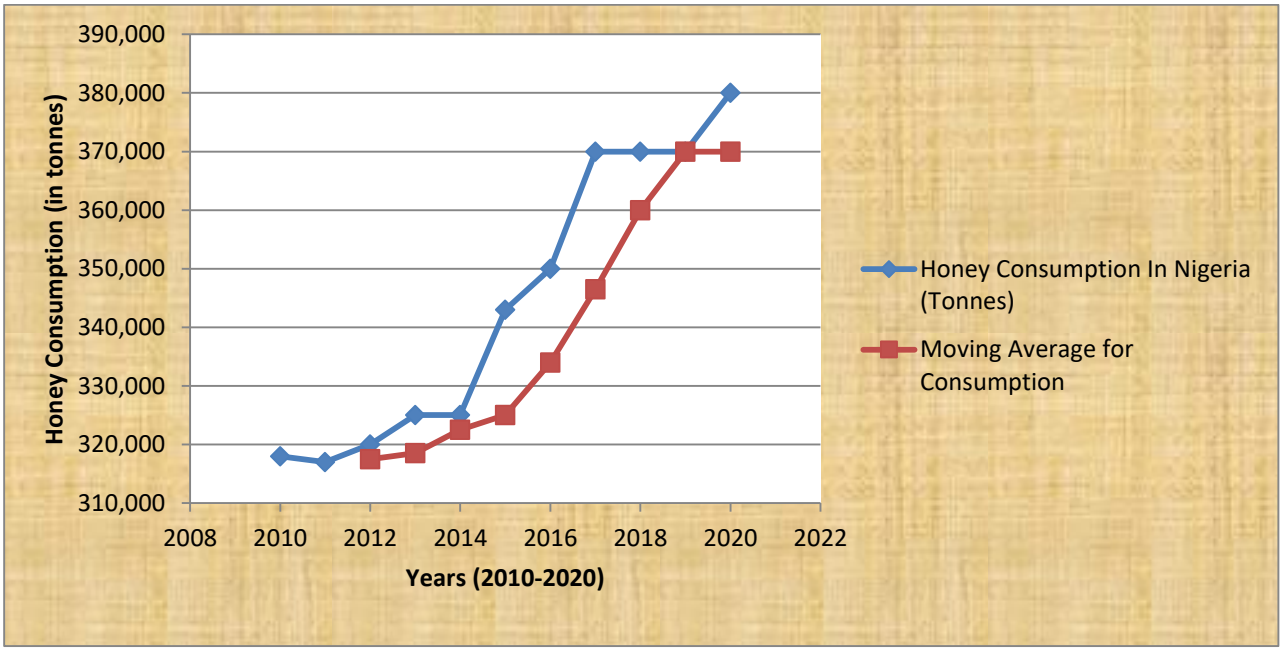


Fig. 10: Honey Consumption in Nigeria and its Moving Average from 2010 to 2020

Despite the country's apicultural potential, what has been achieved so far is only minimal and below the threshold. There are a number of constraints to be mentioned as reasons for inefficient application of improved techniques and less expansion of improved technologies. These includes: limited knowledge and skills of farmers on moveable frame hive beekeeping, shortage of trained extension staff, lack of adequate training institutions and training facilities, limited distribution of improved beekeeping equipment, inadequate production and high prices of moveable frame hives and its accessories, lack of appropriately-trained support personnel or information materials, inadequate organizational support, lack of access to, or non-availability of credit and inadequate research centers to address the problems in different agro- ecologies in the country. Furthermore, the existence of poor coordination between stakeholder's research, extension and farmers, including other sectors like the horticulture, forestry, health, and environment sectors.

Honey quality control is also important to protect honey from adulteration and contamination. Honey is mainly adulterated with various materials by the collectors who are the major practitioners of this act. Unfortunately, some beekeepers too adulterate to level up their production batch. Hence, my recommendation that innovation in modern beekeeping such as database for beekeepers and bee farms in Nigeria, innovative traceability systems, bee data standardization, precision farming, and blockchain technologies becomes a desideratum going forward.

CHAPTER FIVE

BUSINESS MODELS FOR IMPACTFUL HONEY SUPPLY INDUSTRY IN NIGERIA

Key Players in the Nigerian Honey Value Chain and the Degree of Competition

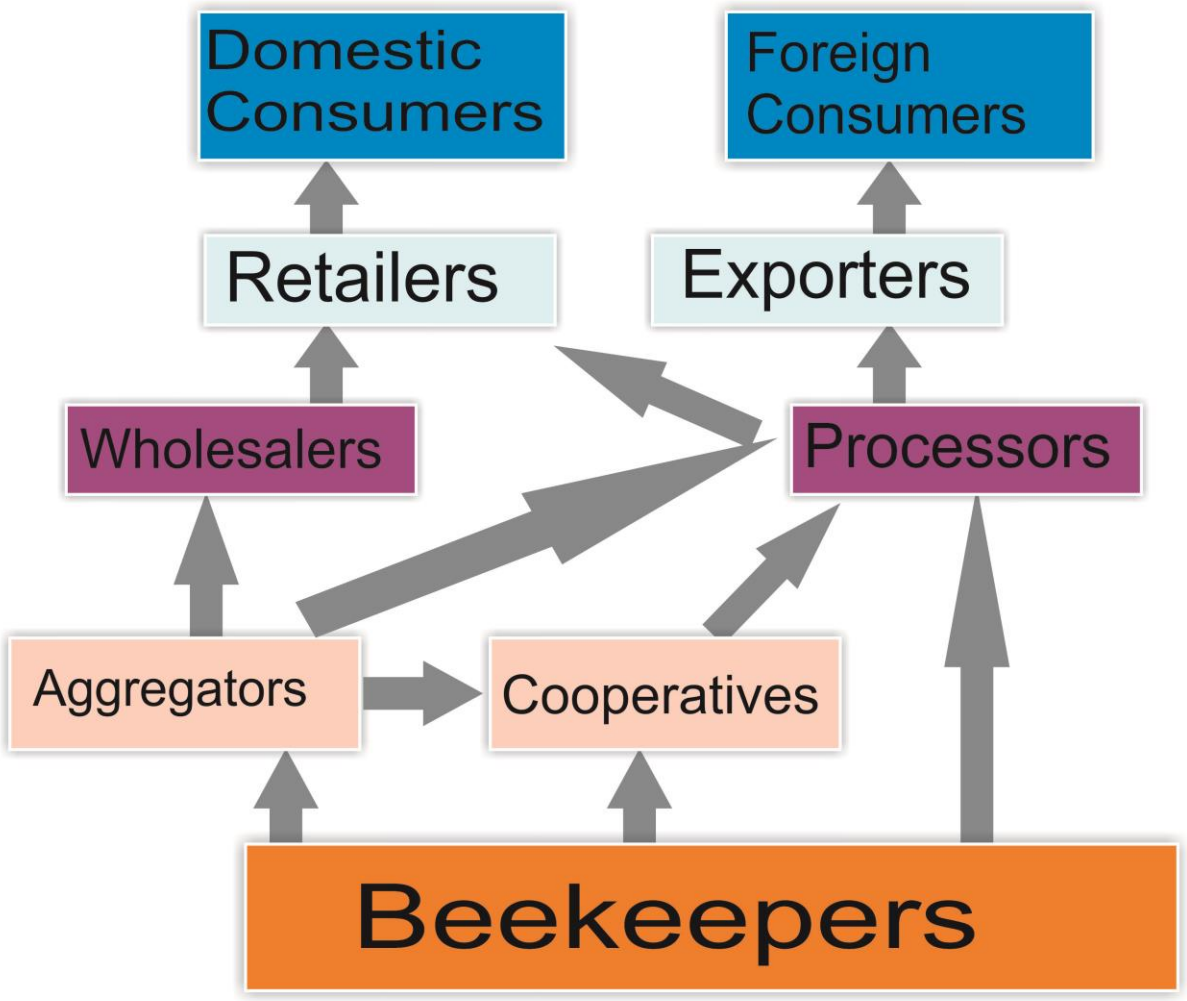
The simplest way to describe the Nigerian value chain is to analyze the levels at which key players compete for honey in the market in terms of sales or purchases of honey. Using this approach, I have identified four main levels.

Level 1: Producers (beekeepers). At this level of the value chain, many beekeepers are engaged in honey production, actively taking advantage of the growing Nigerian honey market's high domestic demand and relatively low supply (when compared with demand). Beekeepers actively seek the best possible (highest) prices for honey.

Level 2: Honey merchants. These are the direct buyers of honey. Also known as honey collectors/traders that buy directly from beekeepers. This level includes a high number of participants in the honey value chain who compete with each other in terms of the purchased quantity, quality, and price of honey. The dominant issue at this level is obtaining an adequate supply of honey, a goal that is affected not only by inadequate honey production but also by the high degree of competition amongst them.

Level 3: Agribusiness companies/honey processors and Honey Exporters. This level of the honey value chain also includes very few participants who are agribusinesses that are engaged in sales for nationwide honey distribution network or export markets in terms of quantity (reliable and timely supply), quality, and price of honey.

Level 4: Domestic retail honey sellers (supermarkets, retail stores). Many participants at this level compete with each other in terms of quantity, quality, and price of honey as they purchase honey from aggregators or wholesaler or directly from the beekeepers.



Courtesy: Agroraf

Fig 11: Honey Value Chain in Nigeria

Trust Issues

Economic growth generally comes from three types of innovation. These are improving a product (product innovation), cost or efficiency gains (process innovation) or creating new types of business (business model innovation). While all drive economic development, the greatest economic growth potential stems from improving and creating new industries and economic opportunities through business model innovation.

Massive adulteration of honey and proliferation of fake honey in Nigerian market has brought about serious trust issues. And without trust, business relationships fail as markets cannot be accessed; buyers and sellers stop working together, and the industry face severe challenges. The greater the trust, the greater the opportunity for economic interactions paving the way for sustainable economic growth. Despite its foundational importance for businesses and the beekeeping/honey industry, building and maintaining trust comes at a high cost to institutions like governments (especially at the international market) and well-respected companies, and that often materializes as a barrier to market entry. But what if the cost of building and maintaining trust was largely reduced through a well coordinated and monitored business model for modern beekeeping and honey supply in Nigeria?

Exclusive Business Models for Modern Beekeeping and Honey Supplies in Nigeria

Building greater trust in our earlier business practices in the honey supply value chain is just one step – that trust building in recent years needs to be entrenched, hence doing so has allowed for the creation and proliferation of new business models that have significant potential to foster economic growth.

In a bid to providing sustainable solutions to the honey supply chain challenges in the country, I am hereby suggesting five models which have been painstakingly analyzed. Therefore, for investors who want to explore the opportunities in modern beekeeping and the honey supply chain in such a way that the nation's GDP will tickled (a positive impact be felt in the national economy thereby igniting the diversification plan of the government), any of the models or a combination of some of them can be adopted for profitability and sustainability. And this does not require billions of naira from government or private investors, but a few hundreds of millions of naira. This industry just has to be developed to tap the unexploited goldmine.

1. Formal Network of Honey Supply Agents

This involves buying honey directly from known and trusted beekeepers or honey aggregators.

As there will be an inevitable trend towards consolidation of both beekeeping operations and honey packing operations. There will also be more direct competition and collaboration between consolidated beekeeping operations and a consolidated honey packing industry.

That is to say there will be an increase in both horizontal and vertical integration of the honey industry as a whole. This consolidation will better help stabilize supply and demand relations, prices and marketing. The sustainability and value of consolidation will depend upon a honey industry based upon integrity and conformity to national honey handling protocol.
For example, twenty reliable honey agents can supply an investor minimum of 200 litres each per month; and in a year, a minimum of 48,000 litres.

BENEFITS ASSOCIATED WITH THIS MODEL

- No land is required for beekeeping
- Time frame required for implementation especially for the investor's projected need can be immediate, but will definitely require import supplementation.
- No cost incurred on empowerment, just cost of getting the honey at reasonable price plus logistics.

CHALLENGES ASSOCIATED WITH THIS MODEL

- No control over quality of honey as honey source can't be easily traced because some go as far as Taraba, Adamawa and Cameroun.
- Packaging adulterated honey is inevitable especially when honey agents discover that demand is steady or even increases. There is always tendency of adulteration. However, checks and balance measures must be put in place to curtail some of these challenges like setting up a mini laboratory in the packaging factory.

2. Establish a Women Empowerment Program

Honey production has the potential to provide employment and reduce poverty among rural families in Nigeria. Here, an investor can provide 20 modern beehives with tools and trainings on modern beekeeping per woman beneficiary. And there can be up to 10 women cooperatives consisting of 10 participants each making 100 direct jobs for women that will be gainfully employed through this model. Each will be able to manage their individual 20 hives efficiently. Age range of prospective women beekeepers should be between 18 years and 50 years. Hence apt to say that, women farmers with some farm experience will have a cumulative knowledge of the entire farming environment. This in turn enables them to adopt modern beekeeping.

Each prospective beekeeper provides the land and the labour. Asking them to provide the land from within their domain, not only reveals their commitment but an act of taking responsibility, the determination to labour for the project and for easy monitoring. The groups can setup same day and harvest same day too. Meanwhile, at least 60% of the hives installed must get colonized by bees. After the first 8 months gestation period, subsequent harvest will be twice or thrice in a year.

In order to achieve good success in this honey production and processing through this model, the women beneficiaries should have some personal qualities and skills that will enhance effective production. Some of these qualities include interest in bees and their characteristics, love for good flowers, being a naturalist who uses good knowledge and skills learnt to harness the bee products. Also the intending honey bee farmers should relate well and have good interaction with experienced bee farmers as mentors. Through these interactions, the new entrants learn the basic modern skills and practices in all the what, why, when and how of managing bees for good yield and many other precautionary measures.

Then the investor buys off the raw produce from the trained bee farmers, process and market the product in differently sized containers that are labeled.

Number of empowered women beekeepers: 100
Number of beehives managed by each: 20 Langstroth hives
Total number of hives: 2,000
Average production honey/beehive/harvest: 10 litres
Price (at which honey will be bought) from the women: ₦1,500

BENEFITS ASSOCIATED WITH THIS MODEL

- This model creates employment opportunities for the rural women. 100 direct jobs and many indirect ones.
- There is assurance of getting honey supplies from them at fair prices
- No land is budgeted for because each beneficiary provides the required land.

CHALLENGES ASSOCIATED WITH THIS MODEL

- Laziness or shady practices on the part of the beneficiaries cannot be ruled out. Hence, sufficient to say there should be a representative of the investor who comes around every month for monitoring and evaluation;
- There is a time lag of 8months which is the gestation period before first harvest, hence there may be need for the investor to outsource within this period before first harvest;
- Unpredictability of weather and nature.

3. Smallholder Beekeeper Empowerment Initiative

For the investor, this involves setting up a vertical integration in honey market by establishing existing beekeepers to supply their commercial needs. It involves giving existing and operational beekeepers the tools and the incentive to sell a greater proportion of an increased honey yield at a consistent, fair price. They must be able to sell more of their honey, by increasing yields and reducing production risks; they must be able to capture a greater amount of the value of their harvest; and they will be enabled to be less vulnerable to seasonal price fluctuations. To make this possible, the investor should embed beekeepers' production within a supportive, self-contained agribusiness ecosystem focused on beekeeping practice improvement and local honey production. To meet the target, 10 smallholder beekeepers should be painstakingly and diligently selected. It is assumed that each of them has at least 20 hives already and the investor shall support each of them with additional 50 hives. With this, the individual beekeeper will still able to effectively manage the farm with no additional employment. The increased volume of honey (i.e. from the additional 50 hives) is 5,000 litres per annum.

This therefore implies giving the beekeepers the assurance to off-take honey at a fair price by buying their honey yield off from them.

Despite that, they can't still be trusted 100 per cent, and in order to ensure that the investor doesn't run into packaging adulterated honey, so there should be the primary (on the spot) check and the secondary laboratory check.

On the spot check shall be conducted always during the collection of the honey yields from each of the beekeepers using a refractrometer to test water content of the honey. And another test to determine adulteration. However these are not comprehensive tests and that is why a secondary laboratory tests comes in by using a standard external laboratory. This is going to be a one-off thing though (i.e. at inception of collecting supplies from them) to reduce cost and it can be made a periodic regimen (say annually) or better still setting up a honey testing laboratory in the factory.

BENEFITS ASSOCIATED WITH THIS MODEL

- There is control over quality of honey
- Packaging adulterated honey is avoidable
- The beekeeper uses his land; hence no cost is incurred on land.

CHALLENGES ASSOCIATED WITH THIS MODEL

- Time frame required to start seeing result is 8 months, meanwhile outsourcing can be carried out during the waiting period;
- Trust issue is another challenge. Honey yield from their farm might be difficult to monitor.
- Some cost will be incurred on empowerment

4. Initiate Large Scale Corporate Bee Farms

As was earlier established that the total honey produced in Nigeria is usually inadequate, and the country only meets part of the domestic consumption from the local honey hunters and traditional beekeepers.

This model involves when an investor establish a HoneyBee commercial apiary to ensure a constant honey supply and to cushion the effects of regular purchase. Commercial bee farm in this sense has to do with keeping a large number of modern hives and equipment in many areas that are bee friendly or where they have managed the environment to suit the bees. The products of such commercial farms are usually more varied and qualitative due to better methods of production, harvesting, extraction, grading and packaging of the products.

Estimated hives needed to achieve 158,400 litres per annum without outsourcing is 5280. However, with outsourcing especially at inception when this project kick-starts, 3000 hives are

needed with a potential yield of 180,000 litres per annum from the third year. Meanwhile, at least 60% of the hives installed must get colonized by bees during the first production year, and a 20% additional colonization at second and third year respectively.

BENEFITS ASSOCIATED WITH THIS MODEL

- This model can boast of improved knowledge, skill, practices and improved tools and facilities, improved quality and quantity of honey that will satisfy both local and export demands of the company. Processing helps to increase and improve the quality and shelf-life of the hive products. The purpose of processing honey is to add value and increase the products' acceptance by the consumers. The processing stages for the production of marketable honey accordingly include uncapping, extraction, settling, filtering, grading, packaging and labeling.
- This model gives the company confidence in the honey products being churned out to the market.
- It creates many direct and indirect jobs
- The project can be started immediately as honey may be outsourced for the first 8 months.

CHALLENGES ASSOCIATED WITH THIS MODEL

- It is cost intensive
- Farmland must be procured to reduce risk and ensure easy monitoring

Table 2: Number of Hives Colonized and Quantity Harvested per Year

YEAR	No of Hives Colonized	Quantity Harvested per year
IST production year	1,800	**36,000L**
2cd production year	2,400	**144,000L**
3rd production year	3,000	**180,000L**
4th production year	3,000	**180,000L**

Table 3: Honey Production on Farm VS. Honey Outsourced per Year

YEAR	Farm Production	Farm Surplus	Quantity Outsourced	Value in (₦) of honey outsourced at 2500/L
IST production year	36,000L	-	122,400L	306,000,000
2cd production year	144,000L	-	14,440 L	36,100,000
3rd production year	180,000L	21,600L	-	-
4th production year	180,000L	21,600L	-	-

It is worthy to note that the useful life of hive is 10 years. Therefore, production continues consistently for the next 10 years unabated.

5. Import Substitution Model

This is a back-up or plan-B model whereby the investor wholly resort to buying pure honey from neighboring countries so as to ensure a constant honey supply and to minimize the risk associated with unavailability of local honey or increasing honey prices in the domestic market. Most of the imported honey comes from Cameroun and preliminary investigations (through phone call interviews) reveal that they are generally adulterated. Let's assume import supplies of 13,200 litres can be gotten per month; and in a year, a minimum of 158,400 litres.

BENEFITS ASSOCIATED WITH THIS MODEL

- No time lag or delay in implementation
- May serve as a window of sustainability by ensuring continuous honey supply in the market.

CHALLENGES ASSOCIATED WITH THIS MODEL

- Unrestricted and unregulated adulteration is likely to occur along the supply chain
- Due to insecurity, there is probable loss of honey merchandise in transit.

It should however be noted that if the investor does not want to wait during the gestation period, and wants to commence production immediately; some of these models can be mutually dependent. For example, honey network agents supplies and import supplies may be used to

commence operation before women empowerment program or HoneyBee Company farm or smallholder support program start yielding fruit due to the bee colony gestation period. Even at that, it is assumed that not all installed hive will colonized (i.e. not all installed hive will give honey during the first production year due to weather, expertise or location). Hence, there might still be outsourcing but at a reduced rate annually. Outsourcing might still continue till the third year when there will be no need for such due to full colonization of all hives and optimum honey production.

Conclusions and Recommendations for Investors in Commercial Honey Supply Value Chain

The value of beekeeping and honey supply chain could be described as sweet as honey itself, not minding other valuable products such as beeswax, pollen (bee bread), propolis, royal jelly, bee venom which are derivable due to the improved methods of production.

The spread of varroa mites, incidence of colony collapse disorder and widespread use of chemicals in Europe and the US; coupled with the suspicion of Chinese and Indian honey due to honey factories and suspected honey laundering activities, has meant that the African honey is the new bride.

African honey production is well below its potential. There are substantial market opportunities for honey and financial returns can be increased. For beekeeping to be fully transformed from a subsistence activity to business, the primary producers must have access to a market chain that is reliable and efficient. In order to provide outlets for honey once domestic markets are saturated, export opportunities need to be developed. Under prevailing market conditions, this is achievable when African honey is sold as a specialty honey, like the Manuka honey. But ours can be differentiated as organic honey because organic certification (as well as fair trade certification), would earn the honey a premium in Europe and other international markets. Key factors going our favour are availability of relatively undisturbed forests and conservative agriculture. Even though in our contemporary agriculture, increase in and unregulated use of pesticides on crop plants is gradually surfacing. "Non-tariff" barriers to trade, which are likely to include uncertainty about the pesticide status particularly of honey, are also likely to become a problem. The European Union (EU), for example, requires that imported honey be certified free from chemical, antibiotic and other residues and that it has a full nutritional analysis.

Hence, the honey supply value chain industry has the potential of giving people opportunities for reliable income generation either through exporting or through job creation. The sector could also have positive spillovers through the provision of major inputs for the development of allied industries, like the brewery and pharmaceutical industries and improve environmental conservation. There are prospects for the sector to complement other efforts to enhance people's standard of living. When effectively supported, the honey industry would be one of the pillars for reducing poverty and economic vulnerability.

There should be a greater degree of business interactions and expert consultations among beekeepers, honey traders, researchers, and other stakeholders involved in the value chain.

Based on the analyses of the five proposed models in the Nigerian honey value chain, given all indices, Model 4 (i.e. HoneyBee Company Farm) is the standing out choice and therefore the choice recommended, because it provides the highest NPV, and highest IRR in terms of financial and economic feasibility with a two-digits ROI.

Table 4: Comparisons of Investment Analyses Results

MODEL	NPV	IRR	ROI	BENEFIT-COST RATIO
Model 1	NGN 3,259,874,215.99	152%	13.60%	1.136
Model 2	NGN 3,415,667,916.33	148%	5.30%	1.05
Model 3	NGN 3,318,834,620.87	153%	13%	1.129
Model 4	NGN 4,038,231,728.78	173%	12.70%	1.127
Model 5	NGN 3,259,874,215.99	152%	13.60%	1.136

More so, Model 4 (i.e. HoneyBee Company Farm) has the highest Social Surplus and the highest Gross margin across the four years (see the table 5 below). Therefore more sustainable jobs, more social contributions to society and the nation's GDP will be enhanced through this model. Model 4 is also the only model that shows significant tendencies of cost reduction across the years.

Table 5: Comparisons of Financial Analyses Results

	MODEL	COST (NGN)	RETURNS (NGN)	GROSS MARGIN (NGN)	SOCIAL SURPLUS
YEAR 1	MODEL 1	473,310,910	537,768,000	69,937,090.00	69,937,090.00
	MODEL 2	510,513,410	537,768,000	85,824,590.00	82,684,590.00
	MODEL 3	476,250,910	537,768,000	80,187,090.00	80,187,090.00
	MODEL 4	477,175,910	537,768,000	149,887,090.00	149,887,090.00
	MODEL 5	473,310,910	537,768,000	69,937,090.00	69,937,090.00
YEAR 2	MODEL 1	469,530,961.00	967,982,400	498,451,439.00	497,933,439.00
	MODEL 2	377,492,711.00	967,982,400	590,489,689.00	577,736,689.00
	MODEL 3	439,093,961.00	967,982,400	528,888,439.00	527,051,439.00
	MODEL 4	112,123,961.00	967,982,400	855,858,439.00	847,708,939.00
	MODEL 5	469,530,961.00	967,982,400	498,451,439.00	497,933,439.00
YEAR 3	MODEL 1	471,474,817.10	1,839,166,560	1,367,691,742.90	1,367,121,942.90
	MODEL 2	365,517,842.10	1,839,166,560	1,473,648,717.90	1,459,620,417.90
	MODEL 3	440,759,217.10	1,839,166,560	1,398,407,342.90	1,396,386,642.90
	MODEL 4	78,462,217.10	1,839,166,560	1,760,704,342.90	1,751,739,892.90
	MODEL 5	471,474,817.10	1,839,166,560	1,367,691,742.90	1,367,121,942.90
YEAR 4	MODEL 1	473,723,128.81	3,678,333,120	3,204,609,991.19	3,203,983,211.19
	MODEL 2	380,434,611.31	3,678,333,120	3,297,898,508.69	3,282,467,378.69
	MODEL 3	442,592,123.81	3,678,333,120	3,235,740,996.19	3,233,518,226.19
	MODEL 4	83,449,423.81	3,678,333,120	3,594,883,696.19	3,585,022,801.19
	MODEL 5	473,723,128.81	3,678,333,120	3,204,609,991.19	3,203,983,211.19

For Model 4 (i.e. HoneyBee Company Farm) to be successfully implemented, the company must procure beekeeping materials that are melliferous (i.e. bee-friendly especially to our African bees), environmentally friendly and durable. The investor must also setup bee farm in an area that has preponderance of bee foraging plants. An area with no chemical, edaphic or geological disturbances.

Assuming that these conditions are fulfilled and that no unanticipated factors in the domestic and/or world economy occur, the implementation risk for Model 4 will be rather low.

If it is properly implemented, Model 4 will improve honey productivity levels and improve its quality, thus resulting in a better, improved supply of honey in Nigeria. The HoneyBee Company Farm will benefit from increased and sustainable supplies and sales, and the government will benefit from increased tax inflows.

Given the likely successful outcomes of Model 4 (positive effects on the honey sector and the Nigerian economy), the question of continuing to build on these improvements arises. To develop a successful and reliable system for honey production and marketing in Nigeria, other aspects of honey production will need to be researched, and more investments will be necessary.

It should however be noted again that Model 4 alone may not be 100% feasible without incorporating Model 1 (Honey Agents) and Model 5 (Import supplementation) especially at inception given the current situation of the industry in Nigeria.

After the above analyses for the business models according to different tools, the following result was reached:

1. There is high demand for honey in the local market.
2. The indicators showed big opportunities to start up. The development of the sector largely depends on the existence of market outlets for the product, matching demand and supply.

The contribution of the sector to the national economy can be further enhanced if the government of Nigeria is fully engaged in supporting the development of the sector, both economic and conservation value. The major development issue is how the public, private and civil society interact and network with each other and participate to regulate and develop an efficient value chain for honey marketing, based on consumer satisfaction, to generate incomes, employment and increase production.

Finally, the results indicate that all the proposed models can benefit the economy and contribute toward an increase in the GDP if properly executed, but Model 4 will yield the most desirable outcomes.

In particular, policymakers can foster the development of these immutable business models in the beekeeping industry in Nigeria and work with the honey industry to enable most viable and sustainable of the business models, creating new markets and opening up access to global markets. At the same time, there is huge economic potential in building the resilience of local and rural economies with access to new markets, financial instruments to help businesses thrive and reduce risk while ensuring price efficiency and authenticity.

The Attention of the Stakeholders to Improve Beekeeping in Nigeria

The Nigerian honey production potential and its likely contribution to poverty reduction and economic development have been recognized and should be incorporated into the working agenda of the Nigerian government, especially the Federal Ministry of Agriculture and Rural Development.

Government can train young people and women through apicultural consultants and thereafter attach them to reputable beekeepers as interns for 3 months and set them up with micro financing to get them started with a couple of hives and then government can arrange to buy the honey and wax directly from them at fair price, and market it. The state governments should have a functional apicultural department under the state's Ministry of Agriculture.

This major challenge of the honey supply chain can only be met by a joint and collaborative effort of beekeepers, honest traders, scientists, private and public laboratories, local technical partners and beekeeper groups, transporters, extension workers, Non-Government Organizations and government legislators. Government can definitely make this work.

The involvement of government at all levels (especially the state governments) includes but not limited to promoting Nigerian honey and to establish promising market linkages between different actors in the honey value chain. Top of these, is to make available large hectares of undisturbed arable land with serene natural ambience and abundant floral population for beekeeping projects. Consequently, the country will be able to additionally expand its potential opportunities for honey exports.

Recently, the Nigerian government attention has been drawn to develop the apiculture subsector as one of its strategies for poverty reduction and diversification of export commodities. But not much effort is visible in terms of initiatives and action plan. These exertions should not be left for the government alone, private sectors as well as non-governmental organizations (NGOs) should take a bold step whose imprints will be firmly etched on the sands of time towards improving the possibility of exploiting the largely untapped potential of the apiculture subsector, and increasing its overall competitiveness through the introduction and promotion of modern beekeeping technology in order to obtain honey and other hive products of good quality for industrial processing and export. This opportunity will give a chance to get support to alleviate major constraints hindering apicultural development in the country.

All stakeholders in the beekeeping industry should know that beekeeping is not just harvesting honey, or any hive products. The following actions are recommended to improve/support this wonderful agricultural sub-sector:

• Support the development of small and medium-sized enterprises (SMEs), innovation and modernization of equipment.

• Support continuous training on sustainable beekeeping.

• Promote the utilization of indigenous honeybee subspecies.

• Implement market/control measures promoting high standards for hive products.

• Promote the development of beekeepers' associations.

• Favour a multisectoral approach that enables producers to engage with stakeholders, institutions and professionals at different levels.

• Provide centralized data (e.g. on apiary density, agricultural land use, ongoing blooming) to assist beekeepers in their decision-making.

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APPENDIX

1. Formal Network of Honey Supply Agents

A) COST-RETURN ANALYSIS

COST ANALYSIS

FIXED COST	QTY	UNIT PRICE	YEAR 1	YEAR 2	YEAR 3	YEAR 4
Refractometer	5.00	10,000.00	50,000.00			
Generator	1.00	150,000.00	150,000.00			
NAFDAC Registration	1.00	300,000.00	300,000.00			
Honey bottle capping machine	1.00	200,000.00				
1000L stainless barrel	20.00	100,000.00	2,000,000.00			
Honey filling machine	1.00	180,000.00	180,000.00			
Factory van	1.00	2,500,000.00	2,500,000.00			
Factory furniture	1.00	300,000.00	300,000.00			
Total Fixed Cost (A)			**5,480,000**			
VARIABLE COST			**PER ANNUM**			
Factory manager	1	80,000.00	960,000.00	1,056,000.00	1,161,600.00	1,277,760.00
Packaging boys	5	20,000.00	1,200,000.00	1,320,000.00	1,452,000.00	1,597,200.00
Accountant	1	40,000.00	480,000.00	528,000.00	580,800.00	638,880.00
Silicon cap plastic bottle	316,800	178.00	56,390,400.00	56,390,400.00	56,390,400.00	56,390,400.00
Outsourced honey	158,400	2,500.00	396,000,000.00	396,000,000.00	396,000,000.00	396,000,000.00
Rent (for processing room)	12	30,000	360,000.00	540,000.00	810,000.00	1,215,000.00
Fuelling (for generator)	3,000	150	450,000.00	495,000.00	544,500.00	598,950.00
Transportation	12	20,000	240,000.00	264,000.00	290,400.00	319,440.00
Taxes	12	20,000	240,000.00	276,000.00	317,400.00	365,010.00
Contingencies	1	100,000	100,000.00	110,000.00	121,000.00	133,100.00
Agric Insurance			11,410,510	12551561	13806717.1	15187388.81
Total Variable Cost (B)			**467,830,910.00**	**469,530,961.00**	**471,474,817.10**	**473,723,128.81**
TOTAL COSTS (A+B)			**473,310,910**			

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ANNUAL RETURNS AFTER SALES

YEAR	Price of a Litre of Honey Sold	Quantity of Honey Sold per Annum (in litres)	Overall Returns (in ₦)	Sales rep Commission (@ 3%)	* Overall Returns -Sales Rep Commission
1st Year	3,500	158,400	554,400,000	16,632,000	**537,768,000**
2cd Year	3,500	285,120	997,920,000	29,937,600	**967,982,400**
3rd Year	3,500	541,728	1,896,048,000	56,881,440	**1,839,166,560**
4th Year	3,500	1,083,456	3,792,096,000	113,762,880	**3,678,333,120**

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The General Key Assumptions

Operational Cost Growth rates assumptions

Growth rate per annum	1ST yr 80%; 2cd yr 90%; 3rd yr 100%
Cost of wages and salaries per annum	5%
Cost of utilities per annum	10%
Cost of land and rent rate per annum	5%
Cost of registrations and permits rate per annum	15%
Cost of maintenance per annum	10%
Cost of miscellaneous expenses rate per annum	10%
Tax rate	20%
Depreciation per annum	10%

Revenue and sales assumption

Selling price for honey (1 litre)	3,500
Working days	5 days a week
Production days	5 days a week
Daily working hours	8 hours
Maximum capacity of honey packaging	660Litres per day

B) CASHFLOW

ANNUAL CASHFLOW PROJECTION (FOR A FORMAL NETWORK OF HONEY SUPPLY AGENTS)

YEAR	YEAR 1	YEAR 2	YEAR 3	YEAR 4
Inflow	NGN	NGN	NGN	NGN
Equity	473,310,910			
Sales	537,768,000	967,982,400	1,839,166,560	3,678,333,120
Other Revenue				
Reinvestment		53,776,800.00	55,171,023.90	142,229,296.68
Total Inflow	**1,011,078,910.00**	**1,021,759,200.00**	**1,894,337,583.90**	**3,820,562,416.68**
Outflow	NGN	NGN	NGN	NGN
Total Variable Cost	467,830,910.00	469,530,961.00	471,474,817.10	473,723,128.81
Fixed Cost Overhead	300,000.00	-	-	-
Fixed Asset (from Asset register)	5,180,000.00	-	-	-
Equipment (10% annual Depreciation)		518,000.00	569,800.00	626,780.00
Total Outflow	**473,310,910.00**	**470,048,961.00**	**472,044,617.10**	**474,349,908.81**
	NGN	NGN	NGN	NGN
Net Cash Flow	*537,768,000.00*	*551,710,239.00*	*1,422,292,966.80*	*3,346,212,507.87*
Cash Brought Forward	537,768,000.00	551,710,239.00	1,422,292,966.80	3,346,212,507.87
Reinvestment (10%)	53,776,800.00	55,171,023.90	142,229,296.68	334,621,250.79
Cash carried down	483,991,200.00	496,539,215.10	1,280,063,670.12	3,011,591,257.08

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C) GROSS MARGIN ANALYSIS

GROSS MARGIN AND PROFIT ANALYSIS

Years	Total Returns (in naira)	Total Variable Cost (in naira)	Gross Margin (in naira)	Annual Depreciation	Profit from project (in naira)
Year 1	537,768,000	467,830,910.00	69,937,090.00	-	69,937,090.00
Year 2	967,982,400	469,530,961.00	498,451,439.00	518,000.00	497,933,439.00
Year 3	1,839,166,560	471,474,817.10	1,367,691,742.90	569,800.00	1,367,121,942.90
Year 4	3,678,333,120	473,723,128.81	3,204,609,991.19	626,780.00	3,203,983,211.19

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BREAK EVEN ANALYSIS	
	(in naira)
Total Variable Cost	467,830,910.00
Total Production	158,400
Unit Variable Cost	2953.477967
Total Fixed Cost	5,480,000
Unit Price	3,500
Contribution	546.5220328
Break Even Point	10027.04314

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Therefore, the business will break even within the 1st year, after selling 10,027 litres out of the expected projection of 158,400 litres in that year.

D) INVESTMENT ANALYSIS

INTERNAL RATE OF RETURN

Initial Outlay	-473,310,910
Year 1	537,768,000.00
Year 2	551,710,239.00
Year 3	1,422,292,966.80
Year 4	3,346,212,507.87
IRR	152%

NET PRESENT VALUE

Year 1		537,768,000.00
Year 2		551,710,239.00
Year 3		1,422,292,966.80
Year 4		3,346,212,507.87
Total PV	NGN	3,733,185,125.99
Initial Outlay		473,310,910
NPV	NGN	3,259,874,215.99

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The IRR for this proposed model is about ten times greater than the discounting rate; meaning the venture is profitable to operate even if the planning horizon is only four years. Meanwhile, the NPV shows that in the next 4 years, the project would have built up about 3.2 billion naira after settling the initial outlay. The results obtained indicate a positive NPV and acceptable IRR.

RETURN ON INVESTMENT	
	(In Naira)
Overall Sales turnover	537,768,000.00
Investment	473,310,910
Net profit	64,457,090
Gross Margin	69,937,090.00
ROI	**13.61834022 %**
Return per Capita Invested	**0.921643866**
Return on Gross Margin	**14.77614154 %**

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BENEFIT-COST RATIO

Cost	473,310,910
Benefit	537,768,000.00
Benefit-Cost Ratio	1.136183402

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SOCIAL SURPLUS

Year	Total Revenue	Material Inputs	Depreciation	Value Added	Total Wages	Social Surplus
Year 1	537,768,000	465,190,910.00	-	72,577,090.00	2,640,000.00	**69,937,090.00**
Year 2	967,982,400	466,626,961.00	518,000.00	500,837,439.00	2,904,000.00	**497,933,439.00**
Year 3	1,839,166,560	468,280,417.10	569,800.00	1,370,316,342.90	3,194,400.00	**1,367,121,942.90**
Year 4	3,678,333,120	470,209,288.81	626,780.00	3,207,497,051.19	3,513,840.00	**3,203,983,211.19**

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With a positive social surplus, this model has a positive impact on yearly basis on the socio-economic position of the nation.

2. Women Empowerment Program

A) COST-RETURN ANALYSIS

COST ANALYSIS

FIXED COST	QTY	UNIT PRICE	YEAR 1	YEAR 2	YEAR 3	YEAR 4
Bee suites	100.00	15,000.00	1,500,000.00			
Smoker	100.00	9,000.00	900,000.00			
Langstroth hives	2,000.00	25,000.00	50,000,000.00			
Honey extractor	2.00	245,000.00	490,000.00			
Refractometer	5.00	10,000.00	50,000.00			
Generator	1.00	150,000.00	150,000.00			
1000L stainless barrel	20.00	100,000.00	2,000,000.00			
NAFDAC Registration	1.00	300,000.00	300,000.00			
Honey bottle capping machine	1.00	200,000.00	200,000.00			
Honey filling machine	1.00	180,000	180,000.00			
Factory van	1.00	2,500,000	2,500,000.00			
Factory furniture	1.00	300,000	300,000.00			
Total Fixed Cost (A)			**58,570,000**			
VARIABLE COST			**PER ANNUM**			
Factory manager	1	80,000.00	960,000.00	1,056,000.00	1,161,600.00	1,277,760.00
Packaging boys	5	20,000.00	1,200,000.00	1,320,000.00	1,452,000.00	1,597,200.00
Beekeeping Consultant	1	1.00	500,000.00	550,000.00	605,000.00	665,500.00
Accountant	1	40,000.00	480,000.00	528,000.00	580,800.00	638,880.00
Silicon cap plastic bottle	316,800	178.00	56,390,400.00	56,390,400.00	56,390,400.00	56,390,400.00
Honey available (for offtake)	24,000	1,500.00	36,000,000.00	151,200,000.00	180,000,000.00	180,000,000.00
Outsourced honey (to complement)	134,400	2,500.00	336,000,000.00	144,000,000.00	96,000,000.00	96,000,000.00
Baiting material	2,000	2,000.00	4,000,000.00	1,600,000.00	640,000.00	-
Pest control packs	2,000	2,000.00	4,000,000.00	7,200,000.00	13,680,000.00	27,360,000.00
Rent (for processing room)	12	30,000	360,000.00	378,000.00	396,900.00	416,745.00
Fuelling (for generator)	3,000	150	450,000.00	495,000.00	544,500.00	598,950.00
Transportation/Vehicle Maintenance	12	20,000	240,000.00	264,000.00	290,400.00	319,440.00
Taxes	12	20,000	240,000.00	276,000.00	317,400.00	365,010.00
Contingencies	1	100,000	100,000.00	110,000.00	121,000.00	133,100.00
Agric Insurance			11,023,010	12125311	13337842.1	14671626.31
Total Variable Cost (B)			**451,943,410.00**	**377,492,711.00**	**365,517,842.10**	**380,434,611.31**
TOTAL COSTS (A+B)			**510,513,410**			

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ANNUAL RETURNS AFTER SALES					
YEAR	Price of a Litre of Honey Sold	Quantity of Honey Sold per Annum (in litres)	Overall Returns (in ₦)	Sales rep Commission (@ 3%)	* Overall Returns -Sales Rep Commission
1st Year	3,500	158,400	554,400,000	16,632,000	**537,768,000**
2cd Year	3,500	285,120	997,920,000	29,937,600	**967,982,400**
3rd Year	3,500	541,728	1,896,048,000	56,881,440	**1,839,166,560**
4th Year	3,500	1,083,456	3,792,096,000	113,762,880	**3,678,333,120**

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B) CASHFLOW

ANNUAL CASHFLOW PROJECTION (FOR WOMEN EMPOWERMENT INITIATIVE STRATEGY)				
YEAR	YEAR 1	YEAR 2	YEAR 3	YEAR 4
Inflow	NGN	NGN	NGN	NGN
Equity	510,513,410			
Sales	537,768,000	967,982,400	1,839,166,560	3,678,333,120
Other Revenue				
Reinvestment		53,776,800.00	63,843,948.90	153,108,296.68
Total Inflow	**1,048,281,410.00**	**1,021,759,200.00**	**1,903,010,508.90**	**3,831,441,416.68**
Outflow	NGN	NGN	NGN	NGN
Total Variable Cost	451,943,410.00	377,492,711.00	365,517,842.10	380,434,611.31
Fixed Cost Overhead	300,000.00	-	-	-
Fixed Asset (from Asset register)	58,270,000.00	-	-	-
Equipment (10% annual Depreciation)		5,827,000.00	6,409,700.00	7,050,670.00
Total Outflow	**510,513,410.00**	**383,319,711.00**	**371,927,542.10**	**387,485,281.31**
	NGN	NGN	NGN	NGN
Net Cash Flow	*537,768,000.00*	*638,439,489.00*	*1,531,082,966.80*	*3,443,956,135.37*
Cash Brought Forward	537,768,000.00	638,439,489.00	1,531,082,966.80	3,443,956,135.37
Reinvestment (10%)	53,776,800.00	63,843,948.90	153,108,296.68	344,395,613.54
Cash carried down	483,991,200.00	574,595,540.10	1,377,974,670.12	3,099,560,521.83

Agroraf- Olufade, Y.A. (2022)

C) GROSS MARGIN ANALYSIS

GROSS MARGIN AND PROFIT ANALYSIS					
Years	Total Returns (in naira)	Total Variable Cost (in naira)	Gross Margin (in naira)	Annual Depreciation	Profit from project (in naira)
Year 1	537,768,000	451,943,410.00	85,824,590.00	-	85,824,590.00
Year 2	967,982,400	377,492,711.00	590,489,689.00	5,827,000.00	584,662,689.00
Year 3	1,839,166,560	365,517,842.10	1,473,648,717.90	6,409,700.00	1,467,239,017.90
Year 4	3,678,333,120	380,434,611.31	3,297,898,508.69	7,050,670.00	3,290,847,838.69

Agroraf- Olufade, Y.A. (2022)

BREAK EVEN ANALYSIS	
	(in naira)
Total Variable Cost	451,943,410.00
Total Production	158,400
Unit Variable Cost	2853.178093
Total Fixed Cost	58,570,000
Unit Price	3,500
Contribution	646.8219066
Break Even Point	90550.42726

Agroraf- Olufade, Y.A. (2022)

Therefore, the business will break even within the 1st year, after selling 90,550 litres out of the expected projection of 158,400 litres of honey in a year.

D) INVESTMENT ANALYSIS

RETURN ON INVESTMENT	(In Naira)
Overall Sales turnover	537,768,000
Investment	510,513,410
Net profit	27,254,590
Gross Margin	85,824,590.00
ROI	**5.338662896 %**
Return per Capita Invested	**0.317561552**
Return on Gross Margin	**16.81142715 %**

Agroraf- Olufade, Y.A. (2022)

INTERNAL RATE OF RETURN	
Initial Outlay	-510,513,410
Year 1	537,768,000.00
Year 2	638,439,489.00
Year 3	1,531,082,966.80
Year 4	3,443,956,135.37
IRR	**148%**

NET PRESENT VALUE		
Year 1		537,768,000.00
Year 2		638,439,489.00
Year 3		1,531,082,966.80
Year 4		3,443,956,135.37
Total PV	NGN	3,926,181,326.33
Initial Outlay		510,513,410
NPV	**NGN**	**3,415,667,916.33**

Agroraf- Olufade, Y.A. (2022)

The IRR for this proposed model is about ten times greater than the discounting rate; meaning the venture is profitable to operate even if the planning horizon is only four years. Meanwhile,

the NPV shows that in the next 4 years, the project would have built up about 3.4 billion naira after settling the initial outlay. The results obtained indicate a positive NPV and acceptable IRR.

BENEFIT-COST RATIO

Cost	510,513,410
Benefit	537,768,000
Benefit-Cost Ratio	1.053386629

Agroraf- Olufade, Y.A. (2022)

SOCIAL SURPLUS

Year	Total Revenue	Material Inputs	Depreciation	Value Added	Total Wages	Social Surplus
Year 1	537,768,000	451,943,410.00	-	85,824,590.00	3,140,000.00	**82,684,590.00**
Year 2	967,982,400	377,492,711.00	9,299,000.00	581,190,689.00	3,454,000.00	**577,736,689.00**
Year 3	1,839,166,560	365,517,842.10	10,228,900.00	1,463,419,817.90	3,799,400.00	**1,459,620,417.90**
Year 4	3,678,333,120	380,434,611.31	11,251,790.00	3,286,646,718.69	4,179,340.00	**3,282,467,378.69**

Agroraf- Olufade, Y.A. (2022)

With a positive social surplus, this model also has a positive impact on yearly basis on the socio-economic position of the community, and economy of the nation at large.

3. Smallholder Bee Farm Support Program

A) COST-RETURN ANALYSIS

COST ANALYSIS

FIXED COST	QTY	UNIT PRICE	YEAR 1	YEAR 2	YEAR 3	YEAR 4
Langstroth hives	500.00	25,000.00	12,500,000.00			
Honey extractor	2.00	245,000.00	490,000.00			
Refractometer	5.00	10,000.00	50,000.00			
Generator	1.00	150,000.00	150,000.00			
1000L stainless barrel	20.00	100,000.00	2,000,000.00			
NAFDAC Registration	1.00	300,000.00	300,000.00			
Honey bottle capping machine	1.00	200,000.00	200,000.00			
Honey filling machine	1.00	180,000	180,000.00			
Factory van	1.00	2,500,000	2,500,000.00			
Factory furniture	1.00	300,000	300,000.00			
Total Fixed Cost (A)			**18,670,000**			
VARIABLE COST			**PER ANNUM**			
Factory manager	1	80,000.00	960,000.00	1,056,000.00	1,161,600.00	1,277,760.00
Packaging boys	5	20,000.00	1,200,000.00	1,320,000.00	1,452,000.00	1,597,200.00
Accountant	1	40,000.00	480,000.00	528,000.00	580,800.00	638,880.00
Silicon cap plastic bottle	316,800	178.00	56,390,400.00	56,390,400.00	56,390,400.00	56,390,400.00
Honey available (for offtake)	10,000	1,500.00	15,000,000.00	45,000,000.00	45,000,000.00	45,000,000.00
Outsourced honey (to complement)	148,400	2,500.00	371,000,000.00	321,000,000.00	321,000,000.00	321,000,000.00
Rent (for processing room)	12	30,000	360,000.00	378,000.00	396,900.00	416,745.00
Fuelling (for generator)	3,000	150	450,000.00	495,000.00	544,500.00	598,950.00
Transportation/van maintenance	12	20,000	240,000.00	264,000.00	290,400.00	319,440.00
Taxes	12	20,000	240,000.00	276,000.00	317,400.00	365,010.00
Contingencies	1	100,000	100,000.00	110,000.00	121,000.00	133,100.00
Agric Insurance			11,160,510	12276561	13504217.1	14854638.81
Total Variable Cost (B)			**457,580,910.00**	**439,093,961.00**	**440,759,217.10**	**442,592,123.81**
TOTAL COSTS (A+B)						
			476,250,910			

Agroraf- Olufade, Y.A. (2022)

ANNUAL RETURNS AFTER SALES					
YEAR	Price of a Litre of Honey Sold	Quantity of Honey Sold per Annum (in litres)	Overall Returns (in ₦)	Sales rep Commission (@ 3%)	* Overall Returns -Sales Rep Commission
1st Year	3,500	158,400	554,400,000	16,632,000	**537,768,000**
2cd Year	3,500	285,120	997,920,000	29,937,600	**967,982,400**
3rd Year	3,500	541,728	1,896,048,000	56,881,440	**1,839,166,560**
4th Year	3,500	1,083,456	3,792,096,000	113,762,880	**3,678,333,120**

Agroraf- Olufade, Y.A. (2022)

B) CASHFLOW

YEAR	YEAR 1	YEAR 2	YEAR 3	YEAR 4
Inflow	NGN	NGN	NGN	NGN
Equity	476,250,910			
Sales	537,768,000	967,982,400	1,839,166,560	3,678,333,120
Other Revenue				
Reinvestment		53,776,800.00	58,082,823.90	145,446,946.68
Total Inflow	**1,014,018,910.00**	**1,021,759,200.00**	**1,897,249,383.90**	**3,823,780,066.68**
Outflow	NGN	NGN	NGN	NGN
Total Variable Cost	457,580,910.00	439,093,961.00	440,759,217.10	442,592,123.81
Fixed Cost Overhead	300,000.00	-	-	-
Fixed Asset (from Asset register)	18,370,000.00	-	-	-
Equipment (10% annual Depreciation)		1,837,000.00	2,020,700.00	2,222,770.00
Total Outflow	**476,250,910.00**	**440,930,961.00**	**442,779,917.10**	**444,814,893.81**
	NGN	NGN	NGN	NGN
Net Cash Flow	*537,768,000.00*	*580,828,239.00*	*1,454,469,466.80*	*3,378,965,172.87*
Cash Brought Forward	537,768,000.00	580,828,239.00	1,454,469,466.80	3,378,965,172.87
Reinvestment (10%)	53,776,800.00	58,082,823.90	145,446,946.68	337,896,517.29
Cash carried down	483,991,200.00	522,745,415.10	1,309,022,520.12	3,041,068,655.58

Agroraf- Olufade, Y.A. (2022)

C) GROSS MARGIN ANALYSIS

GROSS MARGIN AND PROFIT ANALYSIS					
Years	Total Returns (in naira)	Total Variable Cost (in naira)	Gross Margin (in naira)	Annual Depreciation	Profit from project (in naira)
Year 1	537,768,000	457,580,910.00	80,187,090.00	-	80,187,090.00
Year 2	967,982,400	439,093,961.00	528,888,439.00	1,837,000.00	527,051,439.00
Year 3	1,839,166,560	440,759,217.10	1,398,407,342.90	2,020,700.00	1,396,386,642.90
Year 4	3,678,333,120	442,592,123.81	3,235,740,996.19	2,222,770.00	3,233,518,226.19

Agroraf- Olufade, Y.A. (2022)

BREAK EVEN ANALYSIS	
	(in naira)
Total Variable Cost	457,580,910.00
Total Production	158,400
Unit Variable Cost	2888.768371
Total Fixed Cost	18,670,000
Unit Price	3,500
Contribution	611.2316288
Break Even Point	30544.88531

Agroraf- Olufade, Y.A. (2022)

Therefore, the business will break even within the 1st year, after selling 30,544 litres out of the expected projection of 158,400 litres of honey in a year.

D) INVESTMENT ANALYSIS

RETURN ON INVESTMENT	(In Naira)
Overall Sales turnover	537,768,000
Investment	476,250,910
Net profit	61,517,090
Gross Margin	80,187,090.00
ROI	**12.9169496 %**
Return per Capita Invested	**0.767169503**
Return on Gross Margin	**16.83715208 %**

Agroraf- Olufade, Y.A. (2022)

INTERNAL RATE OF RETURN	
Initial Outlay	-476,250,910
Year 1	537,768,000.00
Year 2	580,828,239.00
Year 3	1,454,469,466.80
Year 4	3,378,965,172.87
IRR	153%

NET PRESENT VALUE		
Year 1		537,768,000.00
Year 2		580,828,239.00
Year 3		1,454,469,466.80
Year 4		3,378,965,172.87
Total PV	NGN	3,795,085,530.87
Initial Outlay		476,250,910
NPV	NGN	3,318,834,620.87

Agroraf- Olufade, Y.A. (2022)

The IRR for this proposed model is about ten times greater than the discounting rate; meaning the venture is profitable to operate even if the planning horizon is only four years. Meanwhile, the NPV shows that in the next 4 years, the project would have built up about 3.3 billion naira after settling the initial outlay. The results obtained indicate a positive NPV and acceptable IRR.

BENEFIT-COST RATIO

Cost	476,250,910
Benefit	537,768,000
Benefit-Cost Ratio	1.129169496

Agroraf- Olufade, Y.A. (2022)

SOCIAL SURPLUS

Year	Total Revenue	Material Inputs	Depreciation	Value Added	Total Wages	Social Surplus
Year 1	537,768,000	454,940,910.00	-	82,827,090.00	2,640,000.00	**80,187,090.00**
Year 2	967,982,400	436,189,961.00	1,837,000.00	529,955,439.00	2,904,000.00	**527,051,439.00**
Year 3	1,839,166,560	437,564,817.10	2,020,700.00	1,399,581,042.90	3,194,400.00	**1,396,386,642.90**
Year 4	3,678,333,120	439,078,283.81	2,222,770.00	3,237,032,066.19	3,513,840.00	**3,233,518,226.19**

Agroraf- Olufade, Y.A. (2022)

With a positive social surplus, this model also has a positive impact on yearly basis on the socio-economic position of the community, and economy of the nation at large.

4. HoneyBee Company Farm

A) COST-RETURN ANALYSIS

COST ANALYSIS

FIXED COST	QTY	UNIT PRICE	YEAR 1	YEAR 2	YEAR 3	YEAR 4
Langstroth hives	3,000.00	25,000.00	75,000,000.00			
Bee suits	11.00	15,000.00	165,000.00			
Honey extractor (12 framed)	1.00	950,000.00	950,000.00			
Refractometer	5.00	10,000.00	50,000.00			
Generator	1.00	150,000.00	150,000.00			
1000L stainless barrel	20.00	100,000.00	2,000,000.00			
NAFDAC Registration	1.00	300,000.00	300,000.00			
Honey bottle capping machine	1.00	200,000.00	200,000.00			
Honey filling machine	1.00	180,000	180,000.00			
Factory van	1.00	2,500,000	2,500,000.00			
Farmland	30.00	250,000	7,500,000.00			
Factory furniture	1.00	300,000	300,000.00			
Total Fixed Cost (A)			**89,295,000**			
VARIABLE COST			**PER ANNUM**			
Apiary manager	1.00	40,000.00	480,000.00	528,000.00	580,800.00	638,880.00
Apiary assistant	10.00	20,000.00	2,400,000.00	2,640,000.00	2,904,000.00	3,194,400.00
Factory manager	1	80,000.00	960,000.00	1,056,000.00	1,161,600.00	1,277,760.00
Packaging boys	5	20,000.00	1,200,000.00	1,320,000.00	1,452,000.00	1,597,200.00
Accountant	1	40,000.00	480,000.00	528,000.00	580,800.00	638,880.00
Silicon cap plastic bottle	316,800	178.00	56,390,400.00	56,390,400.00	56,390,400.00	56,390,400.00
Outsourced honey (to complement)	122,400	2,500.00	306,000,000.00	36,100,000.00	-	-
Baiting material	3,000	2,000.00	6,000,000.00	2,400,000.00	1,200,000.00	0
Pest control packs	3,000	2,000.00	6,000,000.00	2,400,000.00	4,560,000.00	9,120,000.00
Rent (for processing room)	12	30,000	360,000.00	378,000.00	396,900.00	416,745.00
Fuelling (for generator)	3,000	150	450,000.00	495,000.00	544,500.00	598,950.00
Transportation/vehicle maintenance	12	20,000	240,000.00	264,000.00	290,400.00	319,440.00
Taxes	12	20,000	240,000.00	276,000.00	317,400.00	365,010.00
Contingencies	1	100,000	100,000.00	110,000.00	121,000.00	133,100.00
Agric Insurance			9,460,510	10,406,561.00	11,447,217.10	12,591,938.81
Total Variable Cost (B)			**387,880,910.00**	**112,123,961.00**	**78,462,217.10**	**83,449,423.81**
TOTAL COSTS (A+B)			**477,175,910**			

Agroraf- Olufade, Y.A. (2022)

ANNUAL RETURNS AFTER SALES					
YEAR	Price of a Litre of Honey Sold	Quantity of Honey Sold per Annum (in litres)	Overall Returns (in ₦)	Sales rep Commission (@ 3%)	* Overall Returns -Sales Rep Commission
1st Year	3,500	158,400	554,400,000	16,632,000	**537,768,000**
2cd Year	3,500	285,120	997,920,000	29,937,600	**967,982,400**
3rd Year	3,500	541,728	1,896,048,000	56,881,440	**1,839,166,560**
4th Year	3,500	1,083,456	3,792,096,000	113,762,880	**3,678,333,120**

Agroraf- Olufade, Y.A. (2022)

B) CASHFLOW

ANNUAL CASHFLOW PROJECTION (FOR AH COMPANY FARM)				
YEAR	YEAR 1	YEAR 2	YEAR 3	YEAR 4
Inflow	NGN	NGN	NGN	NGN
Equity	477,175,910			
Sales	537,768,000	967,982,400	1,839,166,560	3,678,333,120
Other Revenue				
Reinvestment		53,776,800.00	90,148,573.90	184,188,846.68
Total Inflow	**1,014,943,910.00**	**1,021,759,200.00**	**1,929,315,133.90**	**3,862,521,966.68**
Outflow	NGN	NGN	NGN	NGN
Total Variable Cost	387,880,910.00	112,123,961.00	78,462,217.10	83,449,423.81
Fixed Cost Overhead	7,800,000.00	-	-	-
Fixed Asset (from Asset register)	81,495,000.00	-	-	-
Equipment (10% annual Depreciation)		8,149,500.00	8,964,450.00	9,860,895.00
Total Outflow	**477,175,910.00**	**120,273,461.00**	**87,426,667.10**	**93,310,318.81**
	NGN	NGN	NGN	NGN
Net Cash Flow	*537,768,000.00*	*901,485,739.00*	*1,841,888,466.80*	*3,769,211,647.87*
Cash Brought Forward	537,768,000.00	901,485,739.00	1,841,888,466.80	3,769,211,647.87
Reinvestment (10%)	53,776,800.00	90,148,573.90	184,188,846.68	376,921,164.79
Cash carried down	483,991,200.00	811,337,165.10	1,657,699,620.12	3,392,290,483.08

Agroraf- Olufade, Y.A. (2022)

C) GROSS MARGIN ANALYSIS

GROSS MARGIN AND PROFIT ANALYSIS					
Years	Total Returns (in naira)	Total Variable Cost (in naira)	Gross Margin (in naira)	Annual Depreciation	Profit from project (in naira)
Year 1	537,768,000	387,880,910.00	149,887,090.00	-	149,887,090.00
Year 2	967,982,400	112,123,961.00	855,858,439.00	8,149,500.00	847,708,939.00
Year 3	1,839,166,560	78,462,217.10	1,760,704,342.90	8,964,450.00	1,751,739,892.90
Year 4	3,678,333,120	83,449,423.81	3,594,883,696.19	9,860,895.00	3,585,022,801.19

Agroraf- Olufade, Y.A. (2022)

BREAK EVEN ANALYSIS	
	(in naira)
Total Variable Cost	387,880,910.00
Total Production	158,400
Unit Variable Cost	2448.743119
Total Fixed Cost	89,295,000
Unit Price	3,500
Contribution	1051.256881
Break Even Point	84941.18002

Agroraf- Olufade, Y.A. (2022)

Therefore, the business will break even within the 1st year, after selling 84,941 litres out of the expected projection of 158,400 litres of honey in a year.

D) INVESTMENT ANALYSIS

INTERNAL RATE OF RETURN

Initial Outlay	-477,175,910
Year 1	537,768,000.00
Year 2	901,485,739.00
Year 3	1,841,888,466.80
Year 4	3,769,211,647.87
IRR	173%

NET PRESENT VALUE

Year 1		537,768,000.00
Year 2		901,485,739.00
Year 3		1,841,888,466.80
Year 4		3,769,211,647.87
Total PV	NGN	4,515,407,638.78
Initial Outlay		477,175,910
NPV	NGN	4,038,231,728.78

Agroraf- Olufade, Y.A. (2022)

The IRR for this proposed model is about twelve times greater than the discounting rate; meaning the venture is profitable to operate even if the planning horizon is only four years. Meanwhile, the NPV shows that in the next 4 years, the project would have built up about 4billion naira after settling the initial outlay. The results obtained indicate a positive NPV and acceptable IRR.

BENEFIT-COST RATIO

Cost	477,175,910
Benefit	537,768,000
Benefit-Cost Ratio	1.126980614

Agroraf- Olufade, Y.A. (2022)

RETURN ON INVESTMENT	
	(In Naira)
Overall Sales turnover	537,768,000
Investment	477,175,910
Net profit	60,592,090
Gross Margin	149,887,090.00
ROI	**12.69806139 %**
Return per Capita Invested	**0.40425156**
Return on Gross Margin	**31.41128604 %**

Agroraf- Olufade, Y.A. (2022)

SOCIAL SURPLUS

Year	Total Revenue	Material Inputs	Depreciation	Value Added	Total Wages	Social Surplus
Year 1	537,768,000	382,360,910.00	-	155,407,090.00	5,520,000.00	**149,887,090.00**
Year 2	967,982,400	106,051,961.00	8,149,500.00	853,780,939.00	6,072,000.00	**847,708,939.00**
Year 3	1,839,166,560	71,783,017.10	8,964,450.00	1,758,419,092.90	6,679,200.00	**1,751,739,892.90**
Year 4	3,678,333,120	76,102,303.81	9,860,895.00	3,592,369,921.19	7,347,120.00	**3,585,022,801.19**

Agroraf- Olufade, Y.A. (2022)

With a positive social surplus, this model also has a positive impact on yearly basis on the socio-economic position of the community, and economy of the nation at large.

5. Import Substitution Model

A) COST-RETURN ANALYSIS

COST ANALYSIS

FIXED COST	QTY	UNIT PRICE	YEAR 1	YEAR 2	YEAR 3	YEAR 4
Refractometer	5.00	10,000.00	50,000.00			
Generator	1.00	150,000.00	150,000.00			
NAFDAC Registration	1.00	300,000.00	300,000.00			
Honey bottle capping machine	1.00	200,000.00				
1000L stainless barrel	20.00	100,000.00	2,000,000.00			
Honey filling machine	1.00	180,000	180,000.00			
Factory van	1.00	2,500,000	2,500,000.00			
Factory furniture	1.00	300,000	300,000.00			
Total Fixed Cost (A)			**5,480,000**			
VARIABLE COST	PER ANNUM					
Factory manager	1	80,000.00	960,000.00	1,056,000.00	1,161,600.00	1,277,760.00
Packaging boys	5	20,000.00	1,200,000.00	1,320,000.00	1,452,000.00	1,597,200.00
Accountant	1	40,000.00	480,000.00	528,000.00	580,800.00	638,880.00
Silicon cap plastic bottle	316,800	178.00	56,390,400.00	56,390,400.00	56,390,400.00	56,390,400.00
Outsourced honey	158,400	2,500.00	396,000,000.00	396,000,000.00	396,000,000.00	396,000,000.00
Rent (for processing room)	12	30,000	360,000.00	540,000.00	810,000.00	1,215,000.00
Fuelling (for generator)	3,000	150	450,000.00	495,000.00	544,500.00	598,950.00
Transportation/van maintenance	12	20,000	240,000.00	264,000.00	290,400.00	319,440.00
Taxes	12	20,000	240,000.00	276,000.00	317,400.00	365,010.00
Contingencies	1	100,000	100,000.00	110,000.00	121,000.00	133,100.00
Agric Insurance			11,410,510	12551561	13806717.1	15187388.81
Total Variable Cost (B)			**467,830,910.00**	**469,530,961.00**	**471,474,817.10**	**473,723,128.81**
TOTAL COSTS (A+B)			**473,310,910**			

Agroraf- Olufade, Y.A. (2022)

ANNUAL RETURNS AFTER SALES

YEAR	Price of a Litre of Honey Sold	Quantity of Honey Sold per Annum (in litres)	Overall Returns (in ₦)	Sales rep Commission (@ 3%)	* Overall Returns -Sales Rep Commission
1st Year	3,500	158,400	554,400,000	16,632,000	**537,768,000**
2cd Year	3,500	285,120	997,920,000	29,937,600	**967,982,400**
3rd Year	3,500	541,728	1,896,048,000	56,881,440	**1,839,166,560**
4th Year	3,500	1,083,456	3,792,096,000	113,762,880	**3,678,333,120**

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B) CASHFLOW

ANNUAL CASHFLOW PROJECTION (IMPORT SUBSTITUTION STRATEGY)

YEAR	YEAR 1	YEAR 2	YEAR 3	YEAR 4
Inflow	NGN	NGN	NGN	NGN
Equity	473,310,910			
Sales	537,768,000	967,982,400	1,839,166,560	3,678,333,120
Other Revenue				
Reinvestment		53,776,800.00	55,171,023.90	142,229,296.68
Total Inflow	**1,011,078,910.00**	**1,021,759,200.00**	**1,894,337,583.90**	**3,820,562,416.68**
Outflow	NGN	NGN	NGN	NGN
Total Variable Cost	467,830,910.00	469,530,961.00	471,474,817.10	473,723,128.81
Fixed Cost Overhead	300,000.00	-	-	-
Fixed Asset (from Asset register)	5,180,000.00	-	-	-
Equipment (10% annual Depreciation)		518,000.00	569,800.00	626,780.00
Total Outflow	**473,310,910.00**	**470,048,961.00**	**472,044,617.10**	**474,349,908.81**
	NGN	NGN	NGN	NGN
Net Cash Flow	*537,768,000.00*	*551,710,239.00*	*1,422,292,966.80*	*3,346,212,507.87*
Cash Brought Forward	537,768,000.00	551,710,239.00	1,422,292,966.80	3,346,212,507.87
Reinvestment (10%)	53,776,800.00	55,171,023.90	142,229,296.68	334,621,250.79
Cash carried down	483,991,200.00	496,539,215.10	1,280,063,670.12	3,011,591,257.08

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C) GROSS MARGIN ANALYSIS

GROSS MARGIN AND PROFIT ANALYSIS					
Years	Total Returns (in naira)	Total Variable Cost (in naira)	Gross Margin (in naira)	Annual Depreciation	Profit from project (in naira)
Year 1	537,768,000	467,830,910.00	69,937,090.00	-	69,937,090.00
Year 2	967,982,400	469,530,961.00	498,451,439.00	518,000.00	497,933,439.00
Year 3	1,839,166,560	471,474,817.10	1,367,691,742.90	569,800.00	1,367,121,942.90
Year 4	3,678,333,120	473,723,128.81	3,204,609,991.19	626,780.00	3,203,983,211.19

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BREAK EVEN ANALYSIS	
	(in naira)
Total Variable Cost	467,830,910.00
Total Production	158,400
Unit Variable Cost	2953.477967
Total Fixed Cost	5,480,000
Unit Price	3,500
Contribution	546.5220328
Break Even Point	10027.04314

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Therefore, the business will break even within the 1st year, after selling 10,027 litres out of the expected projection of 158,400 litres of honey in a year.

D) INVESTMENT ANALYSIS

INTERNAL RATE OF RETURN

Initial Outlay	-473,310,910
Year 1	537,768,000.00
Year 2	551,710,239.00
Year 3	1,422,292,966.80
Year 4	3,346,212,507.87
IRR	**152%**

NET PRESENT VALUE

Year 1		537,768,000.00
Year 2		551,710,239.00
Year 3		1,422,292,966.80
Year 4		3,346,212,507.87
Total PV	NGN	3,733,185,125.99
Initial Outlay		473,310,910
NPV	**NGN**	**3,259,874,215.99**

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The IRR for this proposed model is about ten times greater than the discounting rate; meaning the venture is profitable to operate even if the planning horizon is only four years. Meanwhile, the NPV shows that in the next 4 years, the project would have built up about 3.2 billion naira after settling the initial outlay. The results obtained indicate a positive NPV and acceptable IRR.

RETURN ON INVESTMENT

	(In Naira)
Overall Sales turnover	537,768,000
Investment	473,310,910
Net profit	64,457,090
Gross Margin	69,937,090.00
ROI	**13.61834022 %**
Return per Capita Invested	**0.921643866**
Return on Gross Margin	**14.77614154 %**

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BENEFIT-COST RATIO

Cost	473,310,910
Benefit	537,768,000
Benefit-Cost Ratio	1.136183402

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SOCIAL SURPLUS

Year	Total Revenue	Material Inputs	Depreciation	Value Added	Total Wages	Social Surplus
Year 1	537,768,000	465,190,910.00	-	72,577,090.00	2,640,000.00	**69,937,090.00**
Year 2	967,982,400	466,626,961.00	518,000.00	500,837,439.00	2,904,000.00	**497,933,439.00**
Year 3	1,839,166,560	468,280,417.10	569,800.00	1,370,316,342.90	3,194,400.00	**1,367,121,942.90**
Year 4	3,678,333,120	470,209,288.81	626,780.00	3,207,497,051.19	3,513,840.00	**3,203,983,211.19**

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With a positive social surplus, this model also has a positive impact on yearly basis on the socio-economic position of the community, and economy of the nation at large.

ABOUT THE AUTHOR

Yusuf Ayodeji Olufade is a creative and passionate professional beekeeper in Nigeria, a bee expert and entomologist with positive outlook to create change by focusing on innovation. Experienced in developing strategic plans, leading operations and people, team player and builder with proven ability to establish and achieve professional and business objectives. Possesses a calm personality, with good oral and written communication skills. Also computer literate with good research skills. He can be reached via WhatsApp: **+2348168925545** and Email Address: **agroraf11@gmail.com**