

Deconstructing smart farming from the perspective of beekeeping technologies: voices from Lira city, mid-north Uganda

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Abstract: Smart farming in less-developing nations and or societies has been discouraged with a pretext that it is an impossible venture to undertake yet every community in the world can be empowered to embrace smart farming for sustainable development and food security. Examining smart farming openings using bee keeping, builds upon our understanding of traditional systems and provides a lens to examine contemporary mechanisms to transformation while applying smart farming initiatives to practice. We identify three key values of bees, namely medicinal, economic and organic, which provide a clear-cut entry into the thinking of smart farming necessary for examining such technologies. This article presents bee-keeping as implemented by Trained Apiary Farmers (TAF) Agri- Tourism Farm in an urban setting of Lira city, and examines it along the three dimensions of medicinal, economic and organic. We conclude that adoption of bee-keeping technologies offers a great hope for the city's economy, therapeutic supplements, and organic needs in countless ways. The study is a huge boost to the academia seeing that medics are now turning to herbal curation, in which bee-keeping is a potential resource.

Keywords: Bee-keeping, smart farming, economic, medicinal, organic.

1. INTRODUCTION

A visit to any smart farmer to identify any technology being practiced covering key issues and aspects of such a technology. It is upon this background that in February 2021, a visitation was made to Trained Apiary Farmers (TAF) Agri- Tourism Farm located in Telela cell, Telela Ward, Lira City - Uganda. The Farm however is venturing into organic farming practices of many enterprises such as Apiary, Local Chicken Farming, Piggery, Rabbit rearing, Fish farming, citrus farming among others. Trained Apiary Farmers (TAF) Assured Mixed Enterprises started as a small scale farm in 2008, with a primary intention of increasing the honey production, fruits production and mixed farming as a business. TAF Assured Mixed Enterprises is registered with the Uganda Registration Service Bureau (URSB) as a Limited liability Company, whose Managing Director is Mr. Tom Anyii Okello. The farm is seated on twelve acres of land partly traditional and partly bought due to the increasing growth of the farm. However, for the purpose of this study a deeper look was carried out into Apiculture which is the rearing of domestic bees.

Background

The origin of Beekeeping is as old as the history of human beings. In the 15000 BC, cave paintings shows drawings related to beekeeping. There are Sumerians and Hittites in Anatolia, in China and India in Asia, in Egypt civilization in Africa and in Europe, there are beekeeping information on tablets, hieroglyphs. Rudimentary and primitive hives were used in the practice of beekeeping before and in the middle Ages, and even in some regions. Beekeeping, which was carried out under primitive conditions until the 17th century, gained a scientific quality during these dates. The biology of bee and bee colony started to be understood and modern bee hives started to be used. Africa is more fortunate than other continents in terms of variety of flowering plants and richness of bee breeds. However, it lags behind the World ranking in

the production of honey per hive. As a result of the development of beekeeping in Africa and in the world, contribution will be made to the fields of economy and health. Because, besides honey, bees contribute to health as well as nutrition by producing pollen, Propolis and royal jelly (Eroğlu & Yuksel, 2020).

Today, beekeeping is one of the most common agricultural activities in the world. Today, there are around 56 million beehives in the world and 1.2 million tons of honey is produced from them. Approximately 1/4 of the honey produced is traded and 90% of the export is made from around 20 honey producer countries. China is the country with the most beehive assets and producing honey (211 thousand tons). These countries are also the world's top honey exporting countries. The countries that import the most honey in the world are Germany, USA, Japan, UK, Italy, Switzerland, France, Austria and other European countries. These countries are also the world's top honey exporting countries. On the other hand, beekeeping is carried out in developed countries in order to increase the quantity and quality in herbal production besides bee production. For example, producers in plant production in the USA pay beekeepers \$ 41 million in bee rent to ensure pollination of the plants they produce, while they earn \$ 3.2 billion from the contribution of bees to their production (Eroğlu & Yuksel, 2020).

In the 1990s, the global honey production was in excess of one million two hundred Metric Tonnes on yearly basis, while bee wax was over fifty thousand Metric Tonnes per year. This does not conform to the high demand of these products in the world and yet the demand keep increasing constantly. However in the said period, trades on honey alone was more than three hundred thousand metric tonnes per year where USA and Europe were the main known importers. World trade in beeswax amounted to about 10 000 MT per annum of which Western Europe accounted for about one half of total imports with the world price averaging about US\$ 4000 (Eroğlu & Yuksel, 2020).

Although several African countries are the major producers of honey, almost nothing is exported because of quality problem. Developing countries are taken as a group accounted for 55.5% total exports. Ethiopia exports honey to traditional customers to the Arab countries (such as Saudi, Yemen) as well USA and Sweden). Developing countries in general and Africa in particular have many honey marketing constraints, namely; quality problem, absence of honey processing facility, absence of appropriate honey container for storage, retail selling and transportation, using honey for beverages, absence of honey producers and collectors cooperative, cultural problems and lack of knowledge about properties of honey and inaccessibility to markets. Price of honey is influenced by: supply and demand condition distribution time transportation and storage nature of the product standardization and promotion, availability of competitive products and tariff and nontariff barriers and government support. Most of the rural beekeepers cannot afford to invest in modern beekeeping inputs, processing, packaging, and transport their products to market to maximize profit. they produce a low quality product that they are forced to sell locally to wholesale buyers at prices much lower than in domestic commercial markets (Gebretsadik & Negash, 2016).

The production of honey in Africa represents 9.8% only in the world while bee wax takes 23.5%. Exports of honey from Sub Saharan African countries some of which was intra African trade in 2004 were 184 metric tonnes (MT) valued at US\$ 469 000 whereas in the same year there were imports of 874 MT valued at US\$ 2 708 000. Exports of beeswax from Sub Saharan Africa in 2004 were 721 metric tonnes (MT) valued at US\$ 465 000 but in the same year there were imports of 255 MT valued at US\$ 224 000. These amounts of exports and imports are minimal in world trade figures. They show, however, that African honey is sold on the world market at a price of US\$ 2549/MT whereas imports are valued at US\$ 3098/MT and beeswax is sold at US\$ 645/MT and bought at US\$ 878/MT. There thus seem to be considerable opportunities not only for increasing the quantity of Africa's major hive products but also for improving their quality.

In East Africa, honey bees provide critical pollination services, nutrition, and income for small-holder farmers and rural families. There is considerable genetic diversity in *Apis mellifera* populations in this region: indeed, five distinct *Apis mellifera* subspecies, each adapted to a specific ecological niche, have been identified in East Africa and in the surrounding region. These bee populations are unmanaged; typically beekeepers set out empty receptacles (traditionally, hollowed-out logs), and bee swarms will occupy them as they migrate into the area. In East Africa, pollinators provide USD \$3.2 million in ecosystem services to 8 crops (beans, cowpeas, butternuts, sunflower, monkey nut, tomatoes, capsicum and passion fruit) which are crops grown in Uganda, Kenya and Tanzania. Furthermore, the honey collected from these colonies serves as an important source of nutrition and income for families.

Given the relatively recent introduction of *Varroa* into this region, the large degree of genetic and ecological diversity, and the lack of confounding factors introduced by intensive management practices, provides an unprecedented opportunity to examine the factors affecting honey bee health, lays the groundwork for long-term monitoring of bee populations in this region, and provides important information for the conservation of populations of this key pollinator species in East Africa (Muli et al., 2014).

Beekeeping in Uganda is important as a source of food, employment, rural poverty alleviation, environmental conservation and diversification of the export base (Commonwealth Secretariat, 2002; FAO, 1990; MAAIF, 2000; TUNADO, 2003). Compared to other agricultural projects, beekeeping is a relatively low investment venture that can be undertaken by most people, including the vulnerable (women, youths, disabled and elderly). Pharmaceutical and cosmetic industries use bee products such as honey, Propolis, royal jelly, bee venom and beeswax (UEPB, 2005). Honey and bee brood are sources of carbohydrate and protein food that rural people can obtain at minimal cost (FAO, 1990). One of the most important services honeybees render to mankind is pollination of agricultural and forestry crops (Muli et al 2014). There is demand for bee-products both locally and internationally.

In 2005, the European Union licensed Uganda to export honey to its market, thus creating an immense opportunity. Uganda has not yet exploited the opportunity to expand into niche markets for special favoured and organic honeys with the same year a total of 30 Metric Tons of honey exported worth US\$ 66,000. However, there is a potential for Uganda to export over 500,000 metric tons of honey per year if all necessary conditions are met. Efforts to increase production to meet demand are however constrained by various challenges related to production, processing, packaging, storage and marketing. Declines in honeybee populations in East Africa due to nest habitat destruction, use of agricultural chemicals, nutritional imbalance, pests, predators and diseases have been reported. Limited studies have been undertaken to ascertain trends in bee populations in Uganda. Some known honeybee pests in Uganda include ants, wax moth, hive beetles, lizards, birds and termites; however, there is a paucity of information in literature about honeybee pests existing in the different agro-ecological zones of the country (Kajobe et al., 2016).

Apiculture is the science of beekeeping. It is the art and science of rearing, breeding and managing honeybee colonies in artificial hives for economic gains. It can be learnt and practiced as a hobby, a part time or full time occupation. Bees do well in natural, undisturbed forests and on integrated farms where there is abundant water and flowering plants since noisy environment can disturb the bees. Bees are social insects that live in groups (Labe, 2017).

Beekeeping which is also referred to as Apiculture is an agricultural practice of keeping or rearing domestic bees for different purposes which includes; commercial purposes especially on bee hive materials, bee products and also for domestic consumption in terms of food especially honey. *Apis* is Latin for bee, and apiculture is the science and practice of bee keeping. The words 'apiculture' and 'beekeeping' tend to be applied loosely and used synonymously: in some parts of the world, significant volumes of bee products are today still obtained by plundering wild colonies of bees. This 'honey hunting' cannot be properly described as 'beekeeping'. Honey hunting still remains an important part of many rural livelihoods and falls within the remit of apiculture. In some parts of the world apiculture forms part of the work of hunter-gatherers, while elsewhere apiculture is practiced by highly industrialized agriculturalists in the world's richest nations. The product that most people first associate with bees is honey, although beekeeping generates much more than just honey. The maintenance of biodiversity and pollination of crops are the most valuable services provided by bees. Honey is just one of several different products that can be harvested: others are beeswax, pollen and Propolis, royal jelly and venom, and the uses and values are medicinal, economic and organic. It is still possible to harvest high quality, excellent products from bees using simple equipment and techniques, building on the traditions held in almost every society (Eroğlu & Yuksel, 2020). For the purpose of this particular study the issue that has been chosen is Beekeeping (Apiculture) which is the rearing of domestic bees for several purposes but focusing the different values of the different bee products that will later on be discussed in this study.

The justification of this study is premised on the easy, affordable and readily available local technologies used in beekeeping and yet the enterprise may not require a very huge amount of capital to initiate the enterprise but with earliest sure and reasonable harvest both for domestic consumption but above all for commercial and organic purposes given the multiple useful products acquired out of Apiculture. Commercial beekeeping, as a form of livelihood diversification, can provide an important source of income that can help buffer against the immediate costs of investment. For the purpose of this study, there are three specific beekeeping aspects that will independently be studied and they include:

a) *The Medicinal Values of bee products* - Beekeeping offers the farmer with several products that are all proven very vital for several health related issues and solutions. Its products like honey, pollen, royal jelly, Propolis, bee venom, beeswax among others have immense medical importance. This study will look into the independent existence of these products and their possible medicinal uses.

b) *The Economic values of the bee products* - Apiculture offers multiple products and all these products have got very high economic outcome. The demands for each of these bee products are enormous both in the market and for domestic use which renders them insufficient and proves a high economic value to the bee farmers. This study will analyse the critical economic values of this sector.

c) *The Organic values of the bee products* - Apiculture sector is very instrumental in organic farming systems and eco systems through the bee feeding systems as they feed and produce most of their products only on nectars of different tree species and this has a lot of organic values to environment and farmers. This study will take into account the organic values of apiculture.

Procedures used during data collection, challenges, and solutions

During the field farm visit for data collection, there were a number of procedures used and each procedure had its independent experience as below:

a) *Interviews* – we had the opportunity to meet the farm Manager Ojur John Justine who answered the unwritten, but guiding questions that enabled me to find the necessary facts required that will be used in this study. However, the challenge encountered here is that, being an employee who was recruited much later, he didn't have every facts at his figure tips and that kept him consulting on phone to the managing director of the farm who at the beginning of the interview was not there physically, but some of these challenges were handled by viewing physically the available documents.

b) *Observations and Discussion* - The farm manager made a field visit with us through the different sites of the different enterprises and we were able to visit most of the sites physically and that provided me the opportunity to physically observe how the different enterprises operate though with specific reference to beekeeping which was chosen as an issue in this study and while on site visit we constantly made discussion on critical matters that would be necessary for this particular study. However, the remoteness of some sites could not allow us to reach since this farm is operated in three different places and this denied me the opportunity to physically observe what takes place in the farm we were unable to reach, but documentary review became the solution to this challenge.

c) *Documentary review* - This is another procedure that was used in obtaining the data that is required for this study. The manager presented the records of the firm which was contained in their daily, weekly, quarterly and annual record book. He also provided a written farm profile that gave the background of the farm, their Vision, Mission Statement and Objective. However, the challenge here is that certain critical documents like certificate of registration were kept by the Managing Director himself who joined us much later and told us the document is in the possession of the daughter who was not there at the time of the visit. However, their ability to memorize the major items required helped us in securing such key information.

2. THE OUTCOMES

This section will present the field outcomes, the results, the actual findings of the three specific aspects named above with other related practices across the same field of Apiculture.

The Medicinal Values of bee products

The products of beekeeping are no longer just honey and wax but now include pollen, Propolis, royal jelly and bee venom. Consequently, colony management differs according to the product required. Since many therapeutic properties have been suggested for each of these products, there is the need to scrutinize, standardize and above all protect their purity. This study will analyse the medicinal values of the above different products independently as seen here below:

Honey - Diabetes Mellitus

According to the managing director, honey demand are very high that they don't even meet the overwhelming demand as many of their customers buy it to treat and cure diabetes, he said he was personally diabetic but when he continued to use honey, his condition does not need any medical intervention as of now, but he is on continuous use of honey as a

treatment solution where instead of sugar, he takes tea with honey and that the same is practiced by many such patients. He said the use of honey to treat diabetes is the number one demand that takes the highest amount of honey, followed by ordinary domestic consumption. He further states that during his training for bee keeping, the value of honey in the treatment of diabetes was stressed. However, this finding is in line with Ediriweera and Premarathna (2012) who states that the use of honey in medications for diabetes is mentioned in Ayurveda since ancient times. In various localities, patients suffering from diabetes mellitus use honey in place of sugar. Bee's honey is beneficial for diabetic patients in two ways. One is; honey being three times sweeter than sugar, one may need a much smaller quantity of honey as a sweetener and honey contains lesser calories than sugar. The other is, by providing vitamins B₂, B₄, B₅, B₆, B₁₁ and vitamin C, and minerals like calcium, iron, zinc, potassium, phosphorous, magnesium, selenium, chromium and manganese. The nutritional values of honey could be altered by feeding the bees with selective food.

The antioxidant property of honey

The manager noted that other customers buy honey as antioxidant and he says much they were told of this value during training, he didn't think it would constitute a serious demand, but several customers have come with medical recommendations from the medical practitioners indicating that they should use honey for different periods of time as antioxidant and this amounts to some measurable amounts of honey sales but cannot be compared to the diabetic cases. He says, with increasing demand for antioxidant supply in the food, honey is becoming popular as a source of antioxidant. Oxidative stress comes from lack of balancing chemical reaction between the production of free radicals and the natural object that protects the body resulting into cellular disruption and damage of structure of the genetic. The molecular mechanisms explaining how normal cells undergo transformation to cancer cells induced by tumour promoters have been the subject of intense investigation. So honey can be used as a natural intervention in this situation.

Honey for treatment and protection against heart diseases

According to the Executive Director of TAF, honey reduces the cholesterol in the arteries and saves the patient from heart attack while for those who have already had an attack, make a paste of honey and cinnamon powder, apply on bread or chapatti instead of jelly and jam and eat it regularly for breakfast, and if they do this process daily, are kept miles away from the next attack, regular use of the above process relieves loss of breath and strengthens the heart-beat. In America and Canada, various. He says some health centres such as Ngetta Health Centre III, and other nursing homes are his daily honey customers for treatment of patients and that by their explanation, they have found that due to the increasing age the arteries and veins, which lose their flexibility and get clogged, are revitalized.

Antibacterial activity

According to farm information, another medicinal use of honey which is a bee product is that it is used in the treatment of antibacterial activity. According to the farm manager Ojur John Justine, those who buy honey for medical purposes will come with a medical note or explain to them the purpose for buying this product as told to them by the physician and buying honey as antibacterial measure was among reasons they sold some quantity of their products. Findings by Abeshu and Geleta, (2016) are in agreement with the above assertion and says honey has proven antimicrobial activity where it inhibits a broad spectrum of bacterial species. The alcohol extracts of honey exhibit an inhibitory effect to array of bacterial species including aerobes and anaerobes, Gram positives, and Gram negatives. Honey has powerful antimicrobial effects against pathogenic and non-pathogenic micro-organisms (yeasts and fungi), even against those that developed resistance to many antibiotics.

Honey used in healing wounds

According to the manager, honey is used for healing wounds and he said he has employed quite a range of people in different enterprises in his farm and some casual labourers get injured and if this happens, they use honey as their only treatment and according, honey is very effective compared to these modern medicine used. So honey is a very effective treatment for wounds of any range. They use it also to stop bleeding on fresh wounds and if the cut is not much, then from five days to at least two weeks there shall have been experienced total cure. Here, he derives many of his customers from accidents victims both in formal hospitals and even at different homes where there ate treatment. This is applied three times a day in their farm and continuously until the result are seen, because honey will also reduce the smell of such a wound. Malone and Tsai (2016) note that given its potential to stimulate healing and antimicrobial properties, honey and bee products are promoted as appropriate alternative treatment for wounds. Honey also has the potential ability to

minimize the odour of offensive smelling wound. The number of studies regarding the use of honey for wound healing is growing, although evidence for treating wounds is still limited. According to expert recommendations, when using honey as a wound dressing, honey should be evenly applied on the dressing pad rather than directly onto the wound. If a non-adherent dressing is used, it should be porous enough to allow the diffusion of honey into the wound.

Medicinal Value of Propolis

TAF also produces propolis also referred to as bee glue which is a gum that is gathered by bees from various plants and they use it to seal holes in their honey combs, and they supply in raw forms and as Stinchar. This will depend on the demand of the customer because while other customers prefer to apply it in its raw form others want the liquid form which is called Stinchar, and the Stinchar is taken in oral form following medical prescription. However, TAF sells propolis in any of the two ways antibiotic, anti-inflammatory, treatment of complicated cough, ulcers and for cancer treatment. According to the TAF, this is the second highly demanded product and they have never produced enough as they receive early booking and as they extract, the market is ready. Basa, Belay, Tilahun, & Teshale, shares a common position with TAF as they say propolis has a long history of being used in folk medicine dating back to many centuries. It also has been reported to possess various biological activities, namely anticancer, antioxidant, anti-inflammatory, antibiotic, antifungal and anti-hepatotoxic. Etymologically, the Greek word propolis means pro, for or in defence and polis, the city that is "defence of the hive." Bees use it to seal holes in their honeycombs, smooth out internal walls, as well as to cover carcasses of intruders who died inside the hive in order to avoid their decomposition. Propolis also protects the colony from diseases because of its antiseptic efficacy and antimicrobial properties. Propolis provides wide beneficial effect on human health. It has been extensively employed by man, especially in folk medicine to treat several maladies. Nowadays, propolis has important pharmacological properties and it can be used for a wide range of purposes as anti-inflammatory and hypotensive agent, immune system stimulant and bacteriostatic and bactericidal agent, among many other uses.

Medicinal Value of Bee Wax

TAF also produces bee wax, and as emulsifier where they use it for the treatment of different skin complications in human beings. They have modified it where they produce soap, lotion, jelly which are all externally applied to the skin for smoothening purposes and also treatment for skin diseases. However, (Bogdanov, 2009) is in tandem with TAF where he says in order to mix the otherwise incompatible beeswax and oils with water, all of which are essential ingredients of any cream or lotion, an emulsifier has to be added. Borax is the classic emulsifier, available in most pharmacies. Today's "high-chemistry" cosmetics use a large array of other synthetic emulsifiers. The chemical process on which the emulsification is based is the saponification of the acids in beeswax, i.e. the result is technically a soap. The associated cleansing effect is exploited in so-called cleansing creams, which are very much like simple skin creams. To remove the free acids from beeswax so that it no longer needs an emulsifier and can be easily mixed with pigments and mineral products, a special process was developed and patented.

Medicinal Value of Pollen

Trained Apiary Farmers says bee pollen is a mixture of pollen grains from various botanical sources, which are collected by the bees and mixed with nectar and secretion from other substances and other enzymes. This product is a combination of different food values such as: Proteins, Vitamins, Carbohydrates, minerals, amino acid, and other minerals which are all chemical and nutritional components required for human body wellbeing. But because of the presence of phenolic compounds with antioxidant activity, there are common medicinal uses of Pollen is on prostrate problems and allergies, antioxidant and very useful Anti-Aging solutions.

Medicinal Value of Royal Jelly

According to TAF, this product is secreted by hypopharyngeal gland which is also referred to as brood food gland, of young worker bees also referred to as the nurse, and its used to feed young bees called larvae and this what the adult queen bee feed on as well. This product is usually fed directly to the queen or larvae as it is secreted, it is not stored. Therefore, it is related to the means and ways of production, it is the food reserved for the queen bee and young bees of four to five days old. It has high nutrition value; just as other honey bee products. Royal Jelly is used to strengthen the immune systems and an energy booster. In addition, according to TAF, this product also have the ability to promote some anti -cancer effects antibiotic, wound healing, and anti-inflammatory. This is one of the most expensive bee products as a unit of measurement goes at 1.5 million Uganda Shillings and yet very high in demand.

Medicinal Value of Bee Venom

According to TAF, honeybee venom is produced by two glands used by bees for stinging purposes strictly by worker bee of the worker bees. One is situated in the abdomen, which is rather long and it is the acids gland of the sting that produces acids, while the other is short, but thick and referred to as alkaline gland. Its production climaxes during the first two weeks of the adult worker's life and reaches a maximum when the worker bee starts to get involved in hive defence and foraging. This reduces as the worker bee gets older. Production of venom by queen bee is highest on emergence, probably because it must be prepared for immediate challenge with other queens. TAF, uses bee venom in two forms as powder and as syrup and the known medicinal usage here is immune boosting. This is by far the most expensive product sold by TAF, and the demand is also highest both locally and abroad as customers who are HIV positive are the most known buyers and now the aged has joined the market as another potential buyer with this Covid-19 trauma steps in. However, Basa et al., (2016) seem to support the TAF practice and says bee venom therapy uses the stings of live bees to relieve symptoms of many syndromes such as pain, loss of coordination and muscle weakness. Stinging is not limited to any specific part of the body, as stings in different places seems to produce different results. Opothrapy researches suggest that certain compound in the bee venom namely; melittin, apamin, phospholipases and adolapin, help reduce inflammation and pain and that the combination of all the ingredients in the bee venom helps the body to release natural healing compounds in its own defence. In the modern world, honey bee venom has found wide uses in treating arthritis and other inflammatory and degenerative diseases.

Economic values of bee products

According to the Executive Director of TAF, he says different bee products has several economic values and uses and that the way to eradicate poverty and hunger is to adapt beekeeping as a source of livelihood as this ventures is least affected by adverse conditions like other agricultural ventures like crops, fishing among others. He says this venture does not require a very high start- up investment unlike other agricultural enterprises like arable farming and it may not require a lot of care as there are very few known diseases from bees. However, he presents the followings as the economic values of beekeeping:

Source of income to the farmer

According to the manager, all the available bee products have got overwhelming demand in the market and according to him all products attracts high prices and translating to high income. He says a bottle of bee venom is charged from Two Million Uganda Shillings and above, and a measurement of Royal Jelly is One Million Five Hundred and the rest of the products are equally sold at good prices, while he states that honey is the only bee product that gives him the least amount of money per year. Last year's income on all the bee products only for TAF was Eighty million Uganda Shillings (UGX 80,000,000). Considering that he also does training on bee keeping on contractual basis and he supplies beekeeping materials as well which are associated income as well, but the figure above is strictly for processed bee products like; honey, bee wax, Royal Jelly, bee venom among others. This means different bee products have a lot of economic values to the farmers venturing in it.

According to TAF, honey as one of the bee products is a very important source of food that is taken in different forms and it is very rich in several natural food nutrients that is good for the healthy body formation. In this region, many small holder farmers do bee keeping purely for domestic consumption as food security as all they produce are consumed locally from home. This is an economic value of bee product intended to reduce hunger and poverty. Another economic value of different bee products is that it is a very good source of revenue to the government. This is done through taxing the internal farmers who practice beekeeping at a commercial level domestically and also those who export the said products thereby contributing to the GDP of Uganda. Records has it that last year 2020. TAF, spent about three million eight hundred and seventy six thousand in taxation under apiculture only for both domestic and foreign sales. If TAF can pay this amount, then it is a clear source of revenue to the government hence an economic value of these bee products.

Many bee products are raw materials for several products, for instance, bee wax is used by several industries for making cosmetics like skin lotion and this is economically viable to both the farmer and the industries that utilizes them. He said that some of these bee products like bee wax, royal jelly and bee venom that are raw materials to some industries are very scarce and they are very expensive. TAF is also engaged in training of other prospecting bee keepers on products extraction and processing currently he is doing training on bee products value addition in Karamoja and at the same time

TAF, is now a place for research especially on bee products management, while it is also a visitation and tourism site on several enterprises including on bee products and all the above activities are carried out at different costs, thereby holding the economic value of the bee products. According to the Managing Director of TAF, he has employed several people, both trained and untrained in the extraction and processing, value addition and marketing of different bee products, meaning that they hold their livelihood through this commitment and employment of these workers in the value chain of bee products management is an economic value to the beneficiaries.

Organic Values of bee products

According to TAF management, they all their products are organic and they under go through organic composition test each time they extract these different bee products, and certification is given to them before they start the sales processes. The Managing Director said, the values they get in keeping their products original are enormous and are not limited to:

The TAF Managing Director said, the organic products keeps intact the originality of their products and this helps them to succeed in foreign market easily and with good prices. According to him, Netherlands and Korea where he sells bee venom, bee wax, royal jelly and honey are very strict on organic composition of any product sold to their countries. Even after passing the organic composition test from Uganda here, his product is subjected to the same test again in order for him to sell abroad and in outright good price. An experience that has made him to specialize in organic production strictly.

Nutritional Value

The TAF Managing Director said honey has got very strong nutritional values but only if it is kept in its organic state. It contains 80 percent natural sugar and water is 18 percent while the remaining 2 percent is made up of Minerals, Proteins, Pollens, and Vitamins. The vitamins in honey include vitamin C, B6, riboflavin, niacin, and thiamine, while the mineral composition in honey include Iron, Manganese, Sodium, Calcium, Copper, Potassium and Phosphorus. Honey also contains 22 amino acids. The variation in the nutritional value of honey depends on the type of flowers the bees has collected nectars from. Therefore, the organic values of honey as food substance lies in the strong composition of the nutrients and minerals that are pure and a requirement for body growth.

3. CONCLUSION

In conclusion, beekeeping which is an agricultural activity is a sector that is gradually and rapidly taking shape in the world where several governments of different countries has taken it up in their policy frame work due to the several values that are attached to the multiple products that are medicinal, economic and organic. It is worth noting that this particular enterprise is quite easy to invest in since the investment cost is affordable even by small holder farmers with minimal demand for land space and yet the market is at the door step. Besides the very important values attached to its products, beekeeping is very essential to our environment and also in pollination of our crops, thereby making the practice far beyond just their product that are directly extracted from the bee hives.

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