ANALYSIS OF URBAN APICULTURE AND ITS CONTRIBUTIONS TO HOUSEHOLD FOOD SECURITY: THE CASE OF KOLFE KERANIO SUB-CITY, ADDIS ABABA, ETHIOPIA

BY

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ADDIS ABABA, ETHIOPIA

NOVEMBER, 2021

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DECLARATION

This thesis entitled "Analysis of urban apiculture and its contributions to household food security" is my original work and has not been presented to any other university for any academic degree. Materials and information other than my own were dually acknowledged.

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This is to certify that the above declaration made by the candidate is correct to the best of my knowledge as an advisor.

Admasu Shibru, **Ph.D**) **11/20/2021**

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As advisor of the thesis, I certify that I have read and evaluated the thesis prepared by Mekonnen Ayele Mamuye under my guidance, entitled "analysis of urban apiculture and its contributions to household food security: the case of Kolfe Keranio Sub-city, Addis Ababa, Ethiopia and I recommend that for open defense as fulfilling the requirement for the degree of Master of Science in Food Security and Development.

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As members of the examining board of thesis open defense, we certify that we have read and evaluate the thesis prepared by Mekonnen Ayele Mamuye entitled "Analysis of urban apiculture and Its contributions to household food security: the case of Kolfe Keranio Sub-city, Addis Ababa, Ethiopia and recommend that it is acceptable as a thesis required for the degree of Master of Science in Food Security and Development.

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Final approval and acceptance of this thesis is contingent upon the candidate's submission of the final copy of the thesis, incorporating all the comments by Examining Board, to the Council of Graduate Studies (CGS) through the Centre Academic Committee (CAC) of the Centre.

_____

Chairperson of the Centre or Graduate Program Coordinator

DEDICATION

I dedicated this thesis to my family, intimate friends and staff members

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Acronyms and Abbreviation

CBMS:	Community-Based Monitoring System
CSA:	Central Statistics Authority
DIFID:	Department For International Development
EBA:	Ethiopian Beekeeper Association
EC:	Ethiopian Calendar
ETB:	Ethiopian Birr
FAO:	Food and Agriculture Organization
FGD:	Focal Group Discussion
GTP:	Growth and Transformation Plan
HEA:	Household Economy Approach
HFIAS:	Household Food Insecurity Access Scale
HH:	Household
IPMS:	Improving Productivity and Market Success
KG:	Kilogram
KII:	Key Informant Interview
MOA:	Ministry of Agriculture
SNV:	Netherlands Development Organization
SPSS:	Statistical Package for Social Sciences
STATA:	Statistical Analysis Software
TOL:	Tolerance
UNEP:	United Nation Environmental Program
VIF:	Variance Inflation Factor

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Abstract

The objective of this study is to analyze urban apiculture and its contributions to household food security in Kolfe Keranio sub-city, Addis Ababa, Ethiopia. Purposive sampling technique was employed for the study area (sub-city and woredas under sub-city) selection while simple random sampling technique was employed to select the urban beekeeper households. The data were collected through urban beekeeper household survey, key informant interviews, field observations and focal group discussions. Both descriptive and econometric models were used to analyze the data. Multiple regression and ordered logit models were employed to determine factors affecting urban apiculture production and determinants of the urban beekeeper household food security, respectively. The multiple regression analysis result revealed that apiary land area, wax foundation use, number of transitional and improved (modern) hives, frequency of extension contact, price of honey, access of swarm and experience of urban beekeeping positively explain the urban apiculture production. But, age of the household head negatively affects urban apiculture production. The food security status of urban beekeeping households were classified in to four as food secure (9 HHs), mildly food insecure (28), moderately food insecure (38) and severely food insecure (3). The result of ordered logit model confirmed that education status of household head, wax foundation use, credit access, urban beekeeping experience and apiary land contribute significantly and positively relate to urban beekeeper household food security, in contrast family size negatively affects the household food security of urban beekeepers. This research concludes that urban apiculture production has its own contributions on household food security. The study recommended the need to enhance intensive use of improved hive with appropriate skill and different technology; and facilitation of inputs such as credit service, swarm, extension service and the need to formulate applicable policy, strategy and package for urban apiculture development.

Keywords: Kolfe Keranio, urban apiculture, food security, ordered logit

CHAPTER ONE: INTRODUCTION

1.1. Background of the Study

Urban agriculture is one of the ever-growing industries which provide food for urban people. Consequently, recent studies more than half of the world's population who lives in the rural area, has been migrating to urban centers estimated by 2030. Urban agriculture sector as a food production industry refers to market gardening (vegetables), horticulture (flowers), sylviculture (fruits), aviculture (eggs), apiculture, etc. Among this, apiculture is commonly known as beekeeping which easily establish with small investment (working area, finance, man power, time etc.). Urban apiculture uses as job opportunities for retired individuals, dependent young children and small-scale urban beekeeper (Ropars et al., 2019).

The term "urban beekeeping" has a number of sociopolitical, commercial, environmental and personal meanings that goes beyond the mere description of the meeting of bees and beekeepers. However, these meanings are seldom articulated openly and hardly related to the relevant fields of urban ecology and political ecology (Sponsler & Bratman, 2020). Bees and beekeeping contribute to the livelihood of people in almost every country in the world. The bees used to vary from region to region, and beekeepers work under different conditions and with very different resources (Bradbear, 2009).

Beekeeping remains a vital economic activity and a possible source of income for farmers in Africa. Therefore, it is necessary to plan to reinforce production and increase the returns from beekeeping. The yield from beekeeping enterprise within the continent depends entirely on the way bees are managed (Weidmann & Kilcher, 2011). In Ethiopia, beekeeping has been practiced for hundreds of years and its potential has been well recognized.

Globally, bees are well known by giving different and valuable products including royal jelly, pollen grain, Venom, Wax, Honey and propolis. But, only Wax and honey are produced in Ethiopia due to the traditional beekeeping experience. From this practice, large amount of wax is produced from traditional hives (EBA, 2011).

In Ethiopia since the country has been practicing over hundred years of beekeeping with wide uses of traditional hives, due to this the country has been exported low as compared to the potential (Haftu & Yoseph, 2018). According to the recent data, about 43,373 metric tons of honey was produced in the country that put the country 1st in Africa and 10th in the world (Kenesa , 2018).

The economic viability of urban beekeeping is intertwined with the city's economy as the purchasing power of various human demographics trending, consumer interest in beekeeping products and services, consumer focus through marketing strategies (Douglas & Sponsor, 2020). It is therefore found necessary to study the economic importance of beekeeping to household food security in Addis Ababa city, to which this study is focusing on.

1.2. Problem Statement

Urban poverty in Ethiopia became important challenge that is enhanced by citizen rapid migration of people to the city, urban unemployment, food inaccessibility, etc. Several studies have mainly focused on food security from the points of rural area agricultural related activities, climate change, range land management, etc. (Getnet, 2017).

Urban apiculture is one of the common practices and has many opportunities. A bee cross pollination service is important for the viability of marketable gardens, orchards and seed industries. Urban beekeeping is becoming increasingly popular in towns and cities for consumption, enjoyment in watching these highly social creatures and the opportunity to join an amateur beekeeping group.

There are more than 10 million bee colonies which are fairly distributed throughout the country in Ethiopia. Among these, the first groups are about seven million which are local hives, the second group, about 500 thousand which are transitional and frame hives. The rest 2.5million bee colonies which are wild bees living everywhere within the country, such as under branches of trees, in craves of rocks, cliffs, and in earth holes Ethiopian Beekeeping Association published book (EBA, 2011).

An urban agriculture policy framework was developed by Addis Ababa city Administration office. This policy promotes urban and peri-urban apiculture in an effort to improve food security, income and employment in an environmentally friendly, social inclusive and gender sensitive manner, while reducing environmental degradation and pollution through sustainable utilization of natural resources (UNEP, 2014).

Urban beekeeping not only produces consumptive products from the beehive, it also plays an important role in balancing nature, especially in the pollination of useful plants. Some of our favorite foods like apples, avocados, peaches, citrus fruits, raspberries, pumpkins are heavily dependent on honey bees' pollination. Urban beekeeping is becoming increasingly popular surrounding cities to consume, to watch these highly social creatures and to join a group of amateur beekeepers.

In developing countries such as Ethiopia, beekeeping is practiced to minimize urban poverty and help insure food security. Its success, however, is influenced by constraints such as institutional factors, social factors, economic factors and input related factors (UNDP, 2014). Moreover, there is no clear evidence as to the contribution of urban apiculture production to household food security in the study area and even in Addis Ababa city administration.

Thus, this research is conducted to analyze the practices of urban apiculture and its contributions to household food security on small scale urban beekeeper households and to identify the influential factors determining urban honey production in Kolfe-Keranio sub-city, Addis Ababa, Ethiopia.

1.3. Objective of the Study

1.3.1. General Objective

The general objective of this study is to analyze urban apiculture and its contributions to household food security in Kolfe Keranio sub-city, Addis Ababa, Ethiopia

1.3.2. Specific Objectives

1. Assess the current urban apiculture practices in the study area
2. Identify the opportunities and challenges of urban apiculture production in the study area
3. Analyze the factors affecting urban apiculture in the study area
4. Assess contributions of urban apiculture to household food security in the study area

1.4. Research Questions

This research is intended to answer the following basic questions which are derivatives of the research objectives:

1. What types of apiculture production practices are employed in the study area?
2. What are the key opportunities and challenges of urban apiculture productions in the study area?
3. What are the major factors affecting urban apiculture in the study area?
4. What are the contributions of urban honey production to household food security in the study area?

1.5. Significance of the Study

The findings and knowledge that would be find out from this research contributes to the better understanding of urban apiculture and its contributions to household food security and helps to the urban agriculture development commission to formulate workable urban apiculture policies, design urban beekeeping strategies as well as prepare programs and projects to sustainably adapt urban agriculture development and urban beekeeping. Furthermore, the information would help to exploit the huge and untouched honey production potentials with a little space urban settings.

1.6. Scope of the Study

The study focused on urban apiculture and its contributions to household food security. It is also made on current urban apiculture practices, factors affecting urban apiculture development, opportunities and challenges of urban apiculture business and contributions of urban apiculture to household food security.

1.7. Limitation of the Study

The main limitations of this study are that it focused on a sub-city, and did not cover all sub-cities of Addis Ababa to examine the current dominated practices of urban apiculture production, main problems that directly affecting urban apiculture development, suitable opportunities of urban beekeeping and its potential contributions in domestic household food security to give generalized conclusions as a city level.

1.8. Organization of the Paper

This study is organized it to five chapters. The first chapter emphasis on introduction part which includes background of the study, problem statement, research objectives, research questions, significance and scope of the study, limitations of study, and ethical consideration. Review of the related literature, including theoretical and empirical parts is presented in chapter two. The third chapter discusses the research methodology and covers description of the study area, the research design, research methods, sampling techniques, target population, data collection methods and data processing and analysis. The fourth chapter presents discussion and results, of the findings of the survey study and findings of the analysis of the data used in the study, and the last chapter presented the summary of findings, conclusion, and recommendations.

1.9. Ethical Consideration

In conducting the research ethical consideration is the main assignment for the researcher to conduct the study in a way that he/she wants to meet. Before the start of the study a supportive letter was sought from the college of development studies, center for food security studies, Addis Ababa University. Also the second supportive letter was sought from Kolfe Keranio sub-city farmers and urban agriculture development office to get official access to collect data at the sample farmers and urban agriculture development office.

The study has ensured that full consent was obtained from the participants prior to the start of the study and the study has ensured respect of the participants and their dignity. Also the adequate level of confidentiality of the research data was ensured.

CHAPTER TWO: RELATED LITERATURE REVIEW

This chapter reviews relevant theoretical and empirical literatures. The theoretical literature review covers concepts and definitions of apiculture production, in general, and specifically, urban apiculture production development trends globally, the role of apiculture as a business, apiculture production livelihood in Ethiopia, challenges, opportunities and its contributions to household food security. The empirical literature review presents the potential of urban apiculture production to household food security in view of its impact on urban institutional, economic, physical / infrastructure and social considerations.

2.1. Theoretical and Historical Development of Apiculture

According to Sen (1981), i.e., the entitlement approach, Food access and ownership is one of the ancient property rights as every society has rules governing their rights. Accordingly, failure in food production directly translates into food entitlement failure and in accessibility of food. The theory of access and sustainable livelihood approach prepare favorable grounds for integration with the access theory to accommodate differences between individuals both inter and intra households (Ribot J., 2003). Access for productive resources were fundamental to the households that rely on livestock and crop production for their livelihoods (Mutea, Rist, & Jacobi, 2020).

Human being concerns in bees started with hunting and robbing from wild colonies in hollow holes, in trees or rocks cavern. Up until the refining of sugar cane within the 19th century, honey was the solitary sweetening agent commonly available. It had been valued not only as food, but also for its uses in traditional medicine. People have perceived and studied apiculture /bees with the target of accelerating the production of hive products and making it easier harvest them. As an agricultural enterprise beekeeping does not require land possession or hire charge, it can be started with equipment and tools that can be obtained nearby and in many instances abilities and awareness required for such an enterprise are found within local traditions. As a business enterprise it offers not only different marketable products, such as honey and wax among others, which important source of income for farm families, but can also offer balancing services, such as crop pollination. Furthermore bee products improve farm family nourishment and can provide f or traditional health care medications (FAO, 2011).

2.1.1. Apiculture Production in Ethiopia

Apiculture is a promising off-farm enterprise, which directly and indirectly contributes to smallholder's income specifically and nation's economy normally. Its significant role in generating and diversifying the income of subsistence Ethiopian smallholder farmers mainly the little land holders and landless (Hafte et al, 2018). Currently, there are three broad classifications of honey production systems in Ethiopia: traditional (forest and backyard), transitional (intermediate) and modern (frame beehive) systems.

Ethiopian honey production is characterized by the widespread use of traditional technology leading to relatively low honey yield and poor honey quality (Aman et al, 2019). It is an environmentally friendly and non-farm enterprise undertaken by farmers and landless people. That means, it doesn't occupy plough land, require less investment and supply quick economic benefits, besides, it being nonpolluting intensive agricultural practice. It plays an excellent roll directly by providing valuable output like honey, beeswax, queen and bee colonies and other products like pollen, bee milk, bee venom and propolis and indirectly by providing nutritional, economic and ecological security. Beside that it also provides an employment opportunity and helps for financial security as an entire (Kenesa, 2018). According to Alemayehu and Aberra (2017) and other studies classification, there three kinds of hives in Ethiopia, the production amount and qualities also varied accordingly.

For instance, successful beekeepers raise their socio-economic standing in areas with subsistence agriculture, and farmers in developing countries can substantially supplement the family income, sometimes even double it. This implies the family will be food secured. The hive occupies little space and bees can collect nectar and pollen from anywhere they will get. Man cannot utilize nectar and pollen within the absence of beekeeping. Bee culture can keep ecological balance, not harm as cultivation of crops and practices of agriculture. The investment and running costs are relatively low with minimal risk. Beekeeping is feasible even for people with few resources; bees are often obtained from the wild, equipment will be made locally, and in most cases bees don't need the beekeepers' help. The honeybee produces honey, beeswax and propolis. These commodities have long time period and might be marketed locally or abroad. The number of your time involved can differ per the beekeepers interest for leisure, sideline or fulltime involvement. The entire family can get involved since men, women, or elder

children can do add most cases at home. A beekeeper can develop knowledge and skill, which is rewarding and generate self-reliance. Other local traders benefit by making hives and equipment, and from using and selling the products (Tessega, 2009). Ethiopia is that the leading honey and beeswax producer in Africa. Honey and beeswax products are a part of the apiculture market, which encompasses a good range of products, from primary commodities to highly processed, high value commodity, (Betela, 2019).

2.1.3. World Urban Apiculture Production Trends

Urban beekeeping started on as a social initiative and nonprofit organizations as a response to a guided tour within the Royal National City Park Stockholm in 2010. The founders leaned that plant species within the park are disappearing because of lack of pollination. Also the founding of bee urban has thus been the results of a decline of pollination services, although no particular formal evaluation of the state of honey bees has been made. Bee Urban aims to boost awareness of this decline and also the overall importance of pollination and thus also connect sustainability talks to their urban apiculture, (Claussnizer, 2014).Beekeeping of the town occurs when the practice of beekeeping is transformed by the exigencies of the urban context into a definite trade, functionally integrated into the lifetime of town, and yet not necessarily attached to any explicit socio ecological agenda. This way of beekeeping is most apparent in (though not limited to) the subset of urban beekeepers (in most places, a little one) for whom beekeeping could be a significant economic activity. The beekeeper is, by practical necessity, aware that beekeeping is contextualized by the ecology of city. The health and productivity of a honey bee colony hinges on the composition and dynamics of the local floral community, on regional weather and climate, and significantly on the choices of neighboring beekeepers with regard to colony density and pest/pathogen management. Moreover, the beekeeper understands that the economic viability of beekeeping is intertwined with the economy of the city: the buying power of various human demographics, the trends in consumer interest in apicultural goods and services, the approach of consumers via marketing strategies. Beekeepers of town become an expert community, a trade guild, with special knowledge of and interest within the socio ecology of town, a minimum of insofar because it pertains to their beekeeping, (Eve, 2020). Beekeeping is said to improve well-being of the beekeepers through increasing the number of tools, equipment and access to basic infrastructure for instance access to roads and markets. Some of

the tools and equipment owned to enhance beekeeping production include bee suits, smokers, beehives and other tools used in apiary management. During beekeeping production, farmers acquire new knowledge and skills particularly those related to beekeeping. This may be acquired from organized trainings or as a result of cumulative experience in beekeeping. These skills enhance beekeepers capabilities. In addition, beekeeping gives an opportunity to farmers to network with other members in the communities. This is mainly through group formation that eases access to extension services. Indirectly, beekeeping improves peoples' quality of life through facilitation of sustainable natural resource management. For instance, it enhances pollination which is very important for production of most seed, cash and food crops and promoting biodiversity. Pollination of agricultural crops is an important agro-technical measure that increases productivity of seeds, fruits and vegetables. Some crops such as rapeseed even require supplementary pollination that is achieved by placing one to two beehives per hectare. It is also known that the closer the hives are to the bloomed field, the greater the pollination effect which expedites production. Although the exact contribution of pollination to yield is hard to measure precisely, it is likely to be much higher than the value of honey, wax and royal jelly (Ahikiriza, 2016)**.**

2.1.4. Challenges of Urban Apiculture

There are some important challenges of apiary once we involved in such dense populated cities like capital of Ethiopia as Beekeeping Policy in Urban Ontario workshops document identified that improper management can cause bee swarming into public space, nuisance impacts on adjacent property, potential neighbor non-support and opinion, Standard Euclidean zoning bylaw, small in scale, limited interest in practice and unlikely to attain reasonable scale of economies to become effective a part of the organic phenomenon are some challenges (University of Toronto, 2012).The unpleasant behaviors of bees (aggressiveness, swarming tendency, and absconding behaviors); lack of skilled manpower and training institutions; low level of technology used, high price of improved beekeeping technologies; poor post-harvest management of beehive products and marketing constraints; indiscriminate application of agrochemicals; honeybee disease, pest and predators; poor extension services; absence of coordination between research, extension and farmers; absence of policy in apiculture; shortage of records and up-to- date information; and inadequate research institutions to deal with the

issues. But of these problems might not be constraints to any or all parts of the country and should not be equally pressing to each place. So it requires characterizing the constraints in their respective places to require an appropriate development measure. Honeybee colonies are subject to variety of natural stress inducers and enemies including weather, natural disasters, pests, predators, parasites, and diseases, the bees and their products are at risk of various diseases, parasites and pests (Sebsib and Yibrah, 2018).

2.1.5. Opportunities of Urban Apiculture

The opportunities of urban apiculture characterized in sight of Economic honey production is higher in urban environment, bee survival is higher in urban environment, beehives are flexible and really land-efficient, there's a rapidly growing marketplace for local and natural products and beekeepers can demand huge price premiums harvest local and natural bee products. Environmentally provide pollination services that are crucial for biodiversity and food security and sheltered from pesticides that will be causing colony collapse disorder. Social integration and adoption as a part of a mixed-use land strategy, many land-use opportunities, from backyards, to commercial areas, supportive component of Urban Agriculture movement furthermore Component of food sovereignty and ecological citizenship (University of Toronto, 2012). Consistent with (Kenesa, 2018) beekeeping practices create job opportunities for landless men and ladies for his or her livelihood because it needs low capital to start out. It could even be observed that several people (intermediaries and traders) participate in honey collection and retailing (at village, district and zonal levels). Many honey processors are engaged in Tej brewing and exporters are flourishing. It may also function job opportunities to local carpenters and organized youths in construction of beehive.

2.1.6. Input supply, Extension and Marketing Services

The beekeeping /honey value chain map and actors and functions are often broadly clustered into three main tiers; the bottom, middle and top tiers. This can be according to their role/s within the production of honey or roles which range from production, handling, processing, and distribution throughout to the top markets. Input suppliers constitute the initial node of the value chain and that they comprise organizations and or individual entrepreneurs involved within the construction of beekeeping gear purchasable to interested producers. Production is

principally through three ownership and tenure systems; individually owned apiaries at the farm level; cooperative society advanced hives and located within the member's farms and collectively owned apiaries mainly found within the adjacent forests. The top markets mostly comprise the eventual consumers of honey. These include but aren't limited to domestic consumers, who use honey as a table food, industries that use honey as a food processing or preservation agent, (SNV, 2009)

Supply of inputs: /accessories especially bee forage, colony bee wax, protective clothing, and beekeeping accessories are at a rudimentary stage. Well-built hives, frames, foundation combs, centrifuges and other hive management equipment are generally expensive and not widely available. For beekeepers within the central and northern parts of the country, it's becoming tougher to obtain bee colonies because of credit constraints. Lack of credit availability prevents farmers from buying high yielding beekeeping equipment and undertaking modern colony management.

Apiculture extension: services aren't well organized and that they lack a strategic approach and coordination. The slow uptake of recent beekeeping methods moreover, indicates that thus far research has contributed less to real innovation in beekeeping; innovation within the sense of turning knowledge into improved productivity and incomes. Beekeepers, honey and beeswax collectors, retailers, Tej brewers, processors and exporters are identified to be the key actors within the value chain of the honey subsector. Three principal channels were identified within the value chain of the subsector. These are Tej brewery channel, honey processing and exporting channel and beeswax channel. These channels are complex and interconnected that means absence of organized marketing channel and lack of formal linkages among the actors, (MOA, 2013)

The studies done in Sude Woreda, Arsi Zone Oromia, the price of honey varies from 50 to 70 Ethiopian birr/kg supported the kind of hive from which the honey was harvested. Within the same manner, the value of honey fluctuates with highest price within the season especially during time of wedding ceremonies (January to April), and also during wet season (June to August) within the period when there was no honey production and lowest price during honey harvesting time (September to November and May). The overall marketing of honey within

the area was promising. They use honey as food, as local drinks (such as mead), medicine and for cultural ceremony purposes (Alemayehu & Abera 2017).

According to (Mikhail, (2017) in Ethiopian Honey Value Chain Players are classified into four levels as follows: Producers (beekeepers). At this level of the value chain, many beekeepers are engaged in honey production, actively taking advantage of the Ethiopian honey market's high domestic demand and comparatively low supply (when compared with demand). Direct Buyers: Honey collectors/traders, cooperatives, tej houses, and agribusinesses/processors that buy directly from beekeepers.

Agribusiness companies that market honey in domestic and export markets and honey wholesalers in in the city (Mercato). This level of the honey value chain also includes multiple participants. Wholesalers in national capital (Mercato) and agribusiness companies that cater to domestic markets compete with agribusinesses that are engaged in sales for export markets in terms of quantity (reliable and timely supply), quality, and price of honey and Domestic retail honey sellers (supermarkets, retail stores) and honey exporters (agribusiness companies /processors). Many participants at this level compete with one another in terms of quantity, quality, and price of honey. Additionally, some agribusinesses/processors that offer honey for export markets also are engaged in sales within the domestic market, in order that they compete with the wholesalers.

2.1.7. Urban Apiculture Contributions in View of Household Food Security

Urban agriculture and food production in cities has recently experienced an enormous growth in interest. In response to concerns about the security and sustainability of our existing food systems, many of us in cities are searching for ways to supply more of the food they eat within the town itself. Advocates of urban beekeeping argue that it may be a secure and healthy practice with variety of environmental, economic, and social benefits, for practitioners and cities alike. While many municipalities in North America have taken steps to legalize and regulate urban beekeeping, existing legislation in Ontario largely prohibits keeping hives in cities, (Young & Zilky, 2012) Urban beekeeping is more and more growing in popularity with corporate initiatives on a world scale (Claussnizer, 2014).

2.2. Empirical Review

2.2.1. Major Challenging Factors of Apiculture

Ethiopia has high and untapped potential to promoting beekeeping, both for local consumption/use and for export purpose. However, like any other livestock production activities, this sub sector has challenging by complicated constraints. The major ceasing constraints are social capitals (lack of skilled man power and awareness of the industry, social resource network…), Economic capital (access to finance, access to market including input, high cost of modern hive and its equipment…), Institutional (lack of government and other institution, accessing or support of technology, extension services and follow up credit accessibility and service, input supply to the beekeeper…), physical capital (tools and equipment, infrastructure and buildings, clean water and energy…) are the limiting factors of beekeeping (Haftey & Gashaw, 2018).

2.2.1.1. Social Capital

Social resources are including such like networks of producers and marketing associations who provide the means for beekeepers to advice their craft, ensure management of their bees, processing for honey and wax, access to market and marketing support are a critical for apiculture development. Beekeeping at household level indifferent countries is a family undertaking, where men provide for harvesting, while women and children tend to honey extraction and processing (FAO, 2009 & 2011).

Concerning human capital for beekeeping (lack of skilled man power): Beekeeping is being suffering from the lack of skilled man power, extension service, appropriately skilled trainers, training materials and training institutions (Fenet & Alemayehu, 2016). The challenges in market-oriented beekeeping development specifically related to knowledge and skills needs and development. Shortage of skilled manpower with ability to understand the existing beekeeping-human relationship and provide context-specific services to make a difference in the productivity and quality of marketable hive products, also there is a substantial difference in beekeeping management skills and knowledge among beekeepers. In this regard, how to improve and address the various knowledge and skills needs of beekeepers will continue as a challenge to the research and development service providers, (IPMS, 2012). It is very important to identify

perceived relative merit of improved beekeeping technology and its relative detriment to determine the perception of beekeepers about improved technology and for appropriate interventions. Improved beekeeping technology requires knowledge of their practical activities, (Dereje et al., 2020).

Inspection of hives is one in every of the mechanisms through which difficulties faced in honey production are observed and identified. This might help to require necessary corrective or precautionary measures and/or to determine on early harvesting before the issues worsen. There are two kinds of hive inspection. These are external (without opening from the hive) and internal (with opening of the hive), (Temesgen, 2018).

According to (Teklu & Dinku, 2016) studies on the inspection of bee colonies by the beekeepers, about 72% of the respondents don't seasonally undertake inspection of their bee colonies. This shows that almost all of beekeepers visit monthly and inspect their beehives outwardly but, they are doing not inspect internally at seasonally unless to test either the hive was stuffed with honey or not. A number of things have prevented the interest of improved methods beekeeping.

2.2.1.2. Economic Capital

Access to finance is a significant for the development of apiculture for purchasing of beekeeping inputs, processing and packaging of hive products. Modern hives and its equipment are too expensive and thus it is not easy to affordable to buy and uses this equipment. Most of urban apiculturist were resource poor and needs start up finance for their urban beekeeping activity, sub-city farmers and agriculture bureau 2020).

Most of improved bee hives equipment's such as, honey extractor, wax and wax printer, smoker, modern hives and so on are too expensive to buy and use it. Cost of honey extractor costs ranges from 4,000-5000 ETB and cost of wax printer ranges 5,000-6,000 ETB (Haftey, Sahle and Gashaw, 2018).

2.2.1.3. Institutional Factors

Apiculture extension services don't seem to be well organized and that they lack a strategic approach and coordination. Moreover, with limited staff, even more limited budget and poor facilities; it's difficult to create an effect, (Hadera, 2019).

Lack of government intervention is the most affecting factor for beekeeping practice. Most of the beekeepers lack the knowledge of appropriate management of beekeeping. In the country there is no concerned university and college which responsible to provide beekeeping diploma or certificate level course in apiculture science. Holeta bee research center is the only institute which provides basic trainings for beekeeping skill improvement but not meet even for the region level of Oromia. Beekeeping is one of the disciplines which suffered and is being suffering from lack of skilled man power (Haftey & Gashaw, 2018).

Lack of inputs and credit services, poor extension services, unsustainable and fragmented supports, lack of data, least research support in generating reasonable and adaptable apiculture technology packages for diverse agro-ecological zones are a number of the explanations for slow uptakes. The estimations are indicating that around 64% of honey production is employed to form tej (Ethiopian mead) while the export amount is extremely small proportion, just less than 1% of the whole honey and beeswax produced. Within the country, formal and full-fledged service providing to test standards for beehives, beeswax, honey and other beekeeping equipment; decrees on quality assurance; and food safety regulations are lacking, (Holeta Bee Research Center, 2015). Supply of inputs/accessories especially bee forage, colony bee wax, protective clothing, and beekeeping accessories are at a rudimentary stage. Well-built hives, frames, foundation combs, centrifuges and other hive management equipment are generally expensive and not widely available. For beekeepers in the central and northern parts of the country, it is becoming more difficult to procure bee colonies due to credit constraints, (MOA, 2013)

Effective bee colony management requires use of appropriate technologies and accessories. Relatively improved box hive demands further input and accessories than traditional beehive. These consist of smoker, bee veil, high boots, glove, overalls, bee brush, water sprayer, queen catcher, decamping knife, honey presser, honey extractor, casting mold and uncapping fork, (Basuma Rasa, 2019). An improved beehive technology influences the efficiency level of honey producers positively. Honey producers who used of improved beekeeping technologies are more efficient than their counterparts, (Kassa & Assefa, 2020).

2.2.1.4. Physical Capital

Successful apiculture enterprise requires production equipment and infrastructure such as transport, energy, water, communication systems and apiary buildings (shade, hive stand, hanging fixed comb/removable comb. Sustainable apiculture equipment can be made locally which, in turn contribute to the livelihoods of other local people (FAO, 2009).

2.2.2. Urban Apiculture Contributions

Beekeeping is considered as live stocks, with the increasing commercial value of honey and bees are becoming a growing generator of income, livelihood strategy and means of ensuring food security for so many small-scale beekeepers (FAO, 2018). Apiculture plays an important role in food security and poverty alleviation in Ethiopia. Food security is not only a matter of producing grains and cereals but it is also the financial power to pay the purchase of cereals and grains, since the product obtain from bee hives are high value products. The income generated through selling of hive products (honey and beeswax) is very significant to purchase cereals and grains for family consumption (Samuel, 2017).

2.2.2.1. Social Contribution

According to (Young & Zilky 2012), from a social perspective, urban beekeeping fits within an emerging model of land-use regulation that moves away from rigid separation of uses and instead looks at ways to create an urban pattern based on fine grained, multi-use communities, in which the practice urban agriculture is a growing area of interest for citizens and policy makers. Urban beekeeping is also part of the concept of 'ecological citizenship,' which seeks to reconnect people living in cities with natural systems and processes through a reintegration of ecology into the urban fabric. One key issue here, from a regulatory perspective, is how we determine personal landowner and user rights.

2.2.2.2. Economic Contributions

Making the economic case for urban beekeeping is not without its challenges. Opponents of urban beekeeping point to its small profit margins, the inconsistency of urban honey, and the difficulty of staying in business in a market saturated by large, commercial beekeepers. However, it is unfair to evaluate urban beekeeping under the same lens as traditional,

commercial beekeeping. Due to higher survival rates and honey yields of urban bees; beehives being extremely land-efficient; and an increasing demand for small-scale, traceable, local food, urban beekeeping has the potential to serve as an important component of a commercialized urban agriculture sector, (Young & Zilky, 2012).

2.2.2.3. Contributions to Environment

The effect of honey bees on urban environment seems to be far less than the effect of the urban environment on the honey bees. Much of this has to do with the fact that urban areas are for the most part artificially shaped. That means that many of its plants and gardens cultivated by humans to have amenity value more than anything else. Even in cases of plant is held for its seeds and a fruit, if it does not carry a desired amount another plant is most likely being added. The dependency on honey bee is therefore no longer given, (Claussnitzer, 2014).Though the city may be an important habitat for honey bees, it is not correct to assume honey bees are an important pollinator for cities. Population density within each hive must also be carefully monitored; crowded hives cause swarms of bees to leave the colony and seek a new home. A new colony of bees is likely to be perceived as an unwelcome addition to public space. These concerns highlight the need for proactive policy and regulation to ensure bee health and public safety are protected and enhanced through responsible practice, (Young & Zilky, 2012).

2.2.2.4. Urban Apiculture Contributions to Food Security

Concept of food security: According world food summit (1996) definition, "Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life".

Just food is one of so many web sites advocating various agricultural activities in the city, including urban apiculture. Urban beekeeping in the New York City is a legalized and supported sector and oversight by government officials (Christine, 2010).

Concepts of food security dimensions: There are four widely acceptable points of food security dimensions based on FAO policy brief (2006). These include food availability, food access, utilization and sustainability of foods. As food access states that, access by individuals to adequate resources for acquiring appropriate foods for a nutritious diet. Entitlements are defined

as the set of all commodity bundles over which a person can establish command given the legal, political, economic and social arrangements of the community in which they live (including traditional rights such as access to common resources).

Beyond dispute there are collective and individual economic benefits to urban beekeeping. The collective benefit is the access of local honey that city dwellers will have if urban apiarists are:

1. Able to maintain their beekeeping in the city and

2. Able and willing to sell their honey. City residents would prefer local honey than imported one, the reason is they build trust for the quality (adulteration free) and prefer the taste of it. The study main focus is the individual access and benefit to those who produce and sell the honey, either they benefit by not having to purchase honey or by the profit generated from sell of their hive products. This sector (economic benefits of urban beekeeping) also entwined with the positive aspects of the local food movement in the city (Christine, 2010).

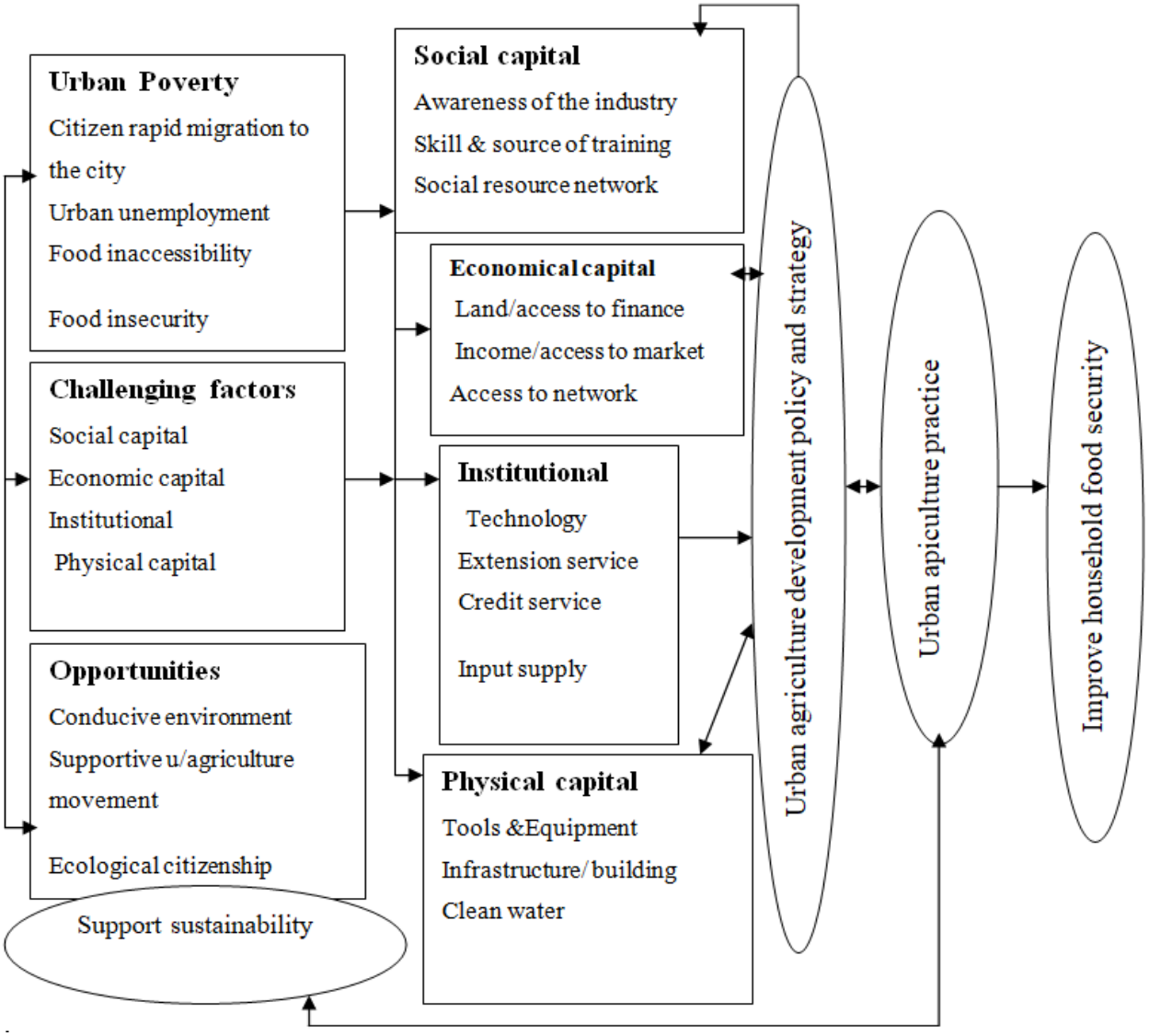
2.2.3. Literature Gap

Based on all the above theoretical and empirical literature reviewed, as my knowledge there were no enough similar previous literatures, which are done on the topics of urban apiculture production sub-sector in the Addis Ababa city. It is the major challenging to compare and contrast my findings. So this study is bridge this literature gap in the country to the future studies and intended to contribute the awareness gap regarding to urban apiculture productions and its contributions to the household food security.

2.2.4. Conceptual Framework

The framework is constructed based on the concepts of sustainable livelihoods framework (DFID, 1999) guidance sheets and reading of various literatures related to apiculture production in a different time and place. The conceptual framework of this study is talk over (see figure 2.1) based on the assumption that to bridge urban apiculture production/practices by small scale apiculture producers development /enterprise are having a great role in improving production and bee yard income to achieve house-hold food security . The linkage between urban apiculture development, social factors (perception, knowledge and attitude), economic capital, institutional

support and physical capital (infrastructure), such variables assumed to affect apiculture yield, house-hold income and food security at the end.



Source: Own construction based on the (DFID) sustainable livelihood framework

Figure 2.1. The study conceptual framework

CHAPTER THREE: METHODOLOGY OF THE STUDY

This chapter contains the description of the study area; research design used and target study population. Data type, source and collection techniques, data processing and analysis employed definition of variables and working hypothesis and their hypothesized relations with urban apiculture production factors in the study area also covered in this chapter.

3.1. Study Area Background

The study was conducted in Addis Ababa City administration. The city occupies a total area of 540 kilometer square and currently the city has 11 Sub City Administration and also117 Districts. The study is a sub-city level study conducted in Kolfe keranio sub-city. Kolfe Keranio is one of the largest sub-cities which has 15 woredas. It is about 9.6 km away from the center of the city and the total area of the sub-city about 6400 hectares, (Minwuyelet, 2004).

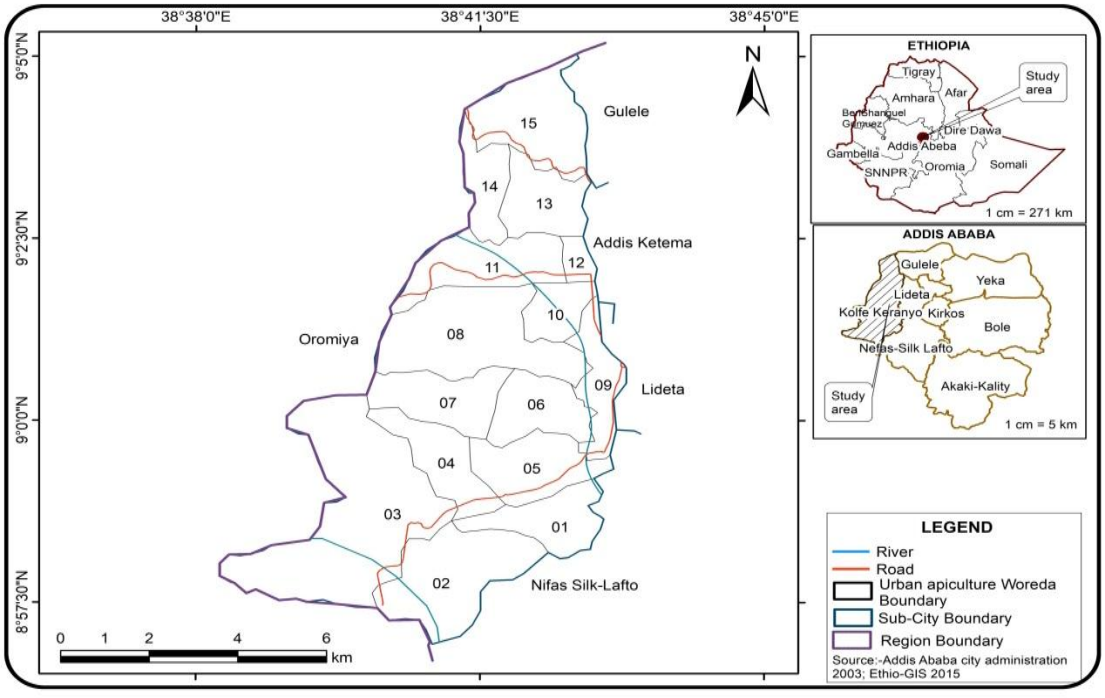


Figure 3.1 : Map of the study area (2021)

3.2. Socio-Economic

According to 2007 E.C national census (CSA), most of the peoples are engaged in trade and manufacturing. Moreover, about 16,602 people are involved in agriculture subsector, such as Animal production, crop production and vegetable garden. The evidence from urban agriculture development commission of Addis Ababa city administration, second Growth and Transformation (GTP-2) plan and based on 2017 urban agriculture livestock production annual report, about 566 urban apiculturalist were identified. This is 87% of the target and 2,059 tones of honey was produced in the city. Moreover, 428 new bee swarms have been distributed for small scale apiculturalist. Currently, the city farmers and urban agriculture development commission report shows that there are about 1027 urban apiculture development participants in the city. From those about 97 are presented in Kolfe Keranio sub-city. The research explains the contribution of urban apiculture to household food security and its challenging constraints.

3.3 Research Design

There are several research designs in use based on the nature and type of the research being done. This study used a cross-sectional survey design that comprised for both quantitative and qualitative data management. The quantitative research mainly focused on gathering quantitative data from urban beekeepers, current most practiced types of hives and assess amount of honey yield and income that urban beekeepers consume and earned from the sale of hive products (honey), which is very important for analyzing the general effects of urban apiculture production through examining by one method of the poverty dimensions of household food security status.

The qualitative research focused on gathering of qualitative data from urban beekeeper households and key informants (cooperatives and hive product traders) about the overall state of urban apiculture practices, its limiting factors, challenge and opportunities of urban itself to beekeeping activities and its contribution to household food security in the sub-city.

3.4. Population and Sample Design

According to Bryman (2003), a study population as the whole group that the research focuses on. According to Addis Ababa city administration farmers and urban agriculture commission 1027 urban apiculture households were identified in the city. From these 673 were male and 354

female beekeeper households. The population for this study consists of Kolfe Keranio sub-city beekeepers. The reasons to be select this sub-city was mainly its beekeeping potential and bee forage availabilities. The bee forage plants species are circled the sub-city from Gullele plant protection center, Sansusi, Burayu and Jemo mountainous part to wards Sabetha outlet. The total population of beekeeping households in Kolfe-Keranio sub city is about 97 households.

The sampling design employed in this study was judgment or purposive sampling for selecting the study area (sub-city and woredas under sub-city).The sampling technique used for selecting the urban beekeeper household is a simple random sampling technique.

3.5. Data Type, Source and Collection Method

Both primary and secondary data were used in this study. The data were collected from April 2021 to July 2021 through formal survey from both primary and secondary sources to meet objectives of the study and in order to answer the research questions (Table 3.1). Primary data were collected from sample household respondents who were engaged in urban apiculture production activities with interviews by using structured and semi-structured questionnaire. The data types include demographic and socioeconomic characteristics of the households, data related to beekeeping and support services. Development agents who were working in the sub-city and each woreda were selected as enumerators to collect data. Before data collection the data collectors were trained on the techniques of data collection and the questionnaire was pre-tested on eight urban beekeeping households to evaluate the appropriateness of the design, language, relevance of the questions and time taken for an interview. All appropriate modification was made on the questionnaire prior to conducting the survey in the study area.

Moreover, Key informants interview and focus group discussion were employed using checklist in order to obtain additional information for this study. The necessary secondary data were collected from governmental institutions such as woredas urban agriculture development office, the city administration and urban agriculture commission experts, Ministry of agriculture and from non-governmental organizations like SNV (Netherlands Development Organization). Secondary data were collected from published and unpublished sources and different websites.

3.6. Sample Size Determination

The sample size was determined by using Yamane T. (1967) sampling formula with 95 percent of confidence level. The formula was used to calculate the sample size from the total population of the sub-city urban beekeepers of fifteen woredas of the sub-city.

To select sample size the following mathematical formula used.

$N = 97$

$$n = \frac{N}{1 + N(e)^2} \quad \text{.....(1)}$$

Where,

N= designates total number of beekeepers population (hh) in the sub-city,

n= represents the sample size,

e= assumed to be represents maximum variability or margin of error 5% (0.05),

1= designates the probability of the event occurring.

$$n = \frac{N}{1 + N(e)^2} = \frac{97}{1 + 97(0.05)^2}$$

$n = 78$

Where

Table 3.1: Sample Distribution of the sub-city

S/No	Selected area (sub-city)	N of (hh) in the sub-city	n of sample (hh) in the sub-city
1.	Kolfe keranio sub-city	97	78

To select sample size from each fifteen woredas the following mathematical formula was used.

$$ni = n \times \frac{Ni}{N} \quad \text{.....(2)}$$

N = total beekeepers of selected fifteen woredas,

Ni = total beekeepers of each woreda,

n = total sample size of beekeepers selected from fifteen woredas,

ni = sample size of selected from each woreda.

Table 3.2: Sample distribution of woredas

Study area	Woredas	Ni (hh) in each woreda		ni sample (hh) for each woreda	
		Male	Female	Male	Female
Kolfe keranio sub-city	Woreda 01	6	1	5	1
	Woreda 02	3	1	2	1
	Woreda 03	15	4	11	4
	Woreda 04	8	2	6	2
	Woreda 05	2	2	1	2
	Woreda 06	1	2	2	0
	Woreda 07	5	0	4	0
	Woreda 08	3	0	2	0
	Woreda 09	3	4	2	4
	Woreda 10	1	1	1	1
	Woreda 11	3	2	2	2
	Woreda 12	0	1	1	0
	Woreda 13	7	3	5	3
	Woreda 14	6	4	4	4
	Woreda 15	7	0	6	0
	Total Male	**70**	**Female 27**	**Male 54**	**Female 24**
Grand Total	**Fifteen woredas**	**97**		**78**	

Source: During survey time (Kolfe Keranio sub-city and fifteen woredas farmers and urban agriculture development office, (2020)).

3.6.1. Sampling Technique for each Woreda

As indicated in above table, the total sample size of 78 respondents was used for the study. This was selected based on sample size determination formula from Yamane (1967).

Table 3.3: Total number of sampled respondents (comment)

No.	Respondents	Method of data collection	Total respondent
1.	Urban beekeeper households	Questionnaires	78
2.	Key informant	Interview	15
3.	FGD	Discussion	2
Total			**95**

Source: Kolfe Keranio sub-city farmers and urban agriculture development office (2021)

3.7. Method of Data Analysis

The study used both qualitative and quantitative method of data analysis. The qualitative type of data were collected through in-depth interview and continuous field observation and analyzed textually. The collected quantitative data were coded and entered in to the analysis software which is called statistical package for social science (SPSS version-25) and Stata version 14. The data collected from urban beekeeper households' survey through questionnaire presented and analyzed through descriptive and inferential statistics. The data analytical techniques are described for each objective as follows:

Objective No. 1.: Analysis of the current urban apiculture practices was made by using descriptive statistical method qualitatively.

Objective No.2.: (opportunities and challenges of urban apiculture). Qualitative analysis is employed by generating descriptive statistics and profitability analysis. The descriptive statistics includes use of graphs and tables used maximum and minimum values, mean, standard deviations, frequencies and percentage. **Objective** No.3 (Analysis of factors affecting urban apiculture): It was analyzed with the aid of inferential statistics including correlation coefficient for continuous explanatory variables, t-test for dummy independent variables, chi square test categorical variables. Finally **econometric model** (multiple linear regression models) is used to analyze the factors affecting urban apiculture development. The reason is multiple linear regression models is recommended for analyzing continuous dependent variable. And, **ordered logistic regression model** was used for food insecurity access scale (HFIAS) natured dependent variable.

Multiple linear regression models: The study was employed by applying multiple linear regression models to analyze the factors affecting urban apiculture productions of households in the study areas. The dependent variable was that of household level urban apiculture a productions practice which is continuous variable for this study. The explanatory variables are composed of institutional factors, access of inputs, infrastructure/physical capital and social factors.

Model specification: Multiple regression models use several explanatory variables to predict the outcome of a response variable. The multiple linear regression model equation is shown as follows.

$$\gamma = \beta_0 + \beta_1\chi_1 + \beta_2\chi_2 + \beta_3\chi_3 + \beta_4\chi_4 + \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\beta_n\chi_n + \varepsilon$$

Where, γ =predicted value which is dependent variable= household level urban honey production

β_0 =the $''\gamma''$ intercept which means the value of $''\gamma''$ when the value of $''\chi''$ is equal to zero.

ε = Standard Error

Checking of multicollinearity

Multicollinearity is a situation where it becomes difficult to identify and separate the effect of explanatory variables on the dependent variable, because there is strong relationship among them. Tolerance (TOL) and variance inflation factor (VIF) are methods used to detect multicollinearity among variables.

$$VIF = \frac{1}{Tolerance}$$

$$Tolerance = \frac{1}{VIF}$$

As a rule, when the VIF rate greater than 10 indicates high collinearity and if tolerance closes to zero also indicates high collinearity among independent variables.

Goodness of fit: Are the measures by R^2 statistics explain in predictor variable. This indicates how many percent of the variation in the dependent variables are explained by the dependent variables.

Objective No. 4.: Analysis of the contributions of urban apiculture to household food security. HFIAS (Household Food Insecurity Access Scale) was analyzed by order logit is used for the

contributions of urban apiculture to house-hold food security or objective four of this study. Because the household food insecurity access scale (HFIAS) is a method based on the idea that the experience of food insecurity (access) causes predictable reactions and responses that can be captured and quantified through a survey and summarized in a scale. Use of HFIAS is constructed from a short questionnaire that captures households' behavioral and psychological manifestations of insecure food access, such as having to reduce the number of meals consumed or cut back on the quality of the food due to a lack of resources. Responses to the questionnaire enable the household to will be pinpointed on a spectrum that indicates the degree of severity of insecure food access. Information gathered from the HFIAS will be used to assess prevalence of household food insecurity of a population, as well as changes in food insecurity over time. This is useful in the context of population-level targeting and program monitoring and evaluation of food access-related activities. The HFIAS has been used in myriad ways to measure food insecurity in various contexts.

3.8. Descriptions of Variables

Dependent variable: The main objective of this study is to analyze urban apiculture and its contributions to household food security. In the sub-city hive products (honey) is produced for both consumption and sell to earn household income for their household food security in the above specified study area. For this study, the annual honey production yield is used as dependent variable and it is a continuous variable measured in kg.

3.8.1. Social, Economic, Institutional and Physical Explanatory Variables

Continuous follow up and rapid detection of honeybee pests at their respective areas has paramount importance to prevent the loss of honey product and the swarm itself due to pest attack. The productivity of frame hive and transitional hives more than triple than that of traditional hives, which is perhaps because of better management practices such as providing wax foundation sheets, recycling drawn-out combs after honey extraction, and a higher frequency of harvesting, (Wolay & Teklebirhan, 2017). According to Nebiyu and Messele on their study (2013), the main purpose of beekeeping is for generating income and household consumption.

Sex of household head (SEX)

It is a dummy variable taking the value of 1 for male and 0 otherwise. Amina (2019) found that the majority of beekeeper were males and were likely to be the dominant users' modern technology in beekeeping. But, it was hypothesized that sex being male or female of household heads both have a positive influence on urban beekeeping practice and management.

Family size of households

Family size is a continuous variable which represents the number of households who participate in urban beekeeping activities. Adult equivalent of a family size is calculated with the conversion factors as well by multiplying each household member through the conversion factor and finally summing it. The household who have more number of family size can share and support urban apiary production activity. Unfortunately, those household who obtain large number of family size might affect negatively food security of urban beekeeper household. This was supported by Ifa (2020) who found that household food consumption have negative effect with the size of household per adult equivalent at 1% significant level.

Age of households

Age is continuous variable that represents the age of household heads in years. The older and retired household heads have more experiences and more risk averters to urban apiculture productions. Therefore the age of the household heads increase, their experience and hobbies to involve in such easily income generating activity expected to involve and support their household food security. Therefore age is hypothesized that, a positive relationship between age of beekeeper and participating in urban beekeeping sector. Age and experience has a valid implication on beekeeping practice to identify the technique and characteristics of apiary management to increase production by using it accordingly (Addisu & Desalegn,2021).

Education level of urban beekeepers

Educational status of the urban beekeeper household is a continues variable using grade levels. As we know education is enhancing urban beekeepers ability to perceive, easily understand to apply, widely use and get more quantity and quality of hive products from urban apiculture sub-

sector. It also enables urban beekeepers to search more production way and easily manageable technique or acceptable (adaptable) by densely populated urban environment friendly urban apiculture practices. This research expected as there is a positive relationship between educational status of urban beekeeper and participation in beekeeping activities and household income from hive products.

Education level of beekeeper households is vital to accept and perceive the characteristics of improved beekeeping. More educated beekeeper has a tendency of access and use information relevant to the beekeeping management and practice (Amsalu, 2020).

Urban apiculture production Experience

The apiary farm experience is a continuous variable which is measuring urban apiculture factors is used in years. Their own self apiary management skill used to minimize their professional expense, maximize production yield, controlling pest and bee pray and timely running the production activities appropriately. So this study supposed that, there is a positive relationship between self-experience and urban apiculture better production. The hypothesis also supported by (Ropars et al., 2019), that stated as principal role of urban apiarist in the city is to insure, that the well-being of urban colonies management, which is too different from country side beekeeping management.

Government involvement and attention

This explanatory variable is categorical which represented as (0- Excellent), (1- Very good); (2- Good) and (3- Poor). Based on Fente and Alemayehu (2016) study inadequate government support and promotion of apiculture industry development cease its potential contributions as a country level. Absence of adequate bee research and research center, training institutions, strong policy and strategy are lagging its contributions.

Apiary land size in (meter squire)

Apiary land size of the urban beekeeper households play a significant role to placing a hives and properly manage it. It is a continuous variable which measured in hectares (h). Based on Berquist, et al. (2012) for urban environment apiary land can be integrated as mixed use land part

policy is an important issue for the urban apiary. This urban land use opportunities for beekeeping include from back yard to commercial areas with a supportive component of urban agriculture movement to incorporate as a part of urban food sovereignty and bee ecological citizenship in the urban ecology.

Price of honey

This explanatory variable is a continuous that explained by price/kg the household obtain. According to Nasir et al (2020) in rural side most beekeeper households were price taker and not decision maker when and with how much price they want to sell their hive products. This implies no ready market access which attracts beekeeper households at rural side. Their study percentage shows that 72% price decision share determine by buyers, 24% by both negotiation and the only share of 4% selling price determined by beekeeper own.

Types of hives used (traditional, transitional and modern hives)

This is a dummy variable that affect positively the production amounts of hive products of the urban beekeeper households. This variable also assumed positively affected the annual income of urban beekeepers households. This indicate that apiculture producers with improved hive type and with more number of improved bee hives can harvest more volume of honey and it is also used to maximize and having of marketable surplus as well as able to sell more to earn better income for households Kassa et al, (2018)

Access of Credit Service

This is a dummy variable (1=Yes 0=No) it is used to measure whether the urban beekeeper household heads have to credit access or not. Credit is a major input in startup capital like as urban agricultural activities (dairy production, fattening, poultry and horticulture) production activities. Therefore this study hypothesized that there is a positive relationship between credit access and urban beekeeper household's income from urban bee hive products.

Bee swarm is a liquid asset easily to change in to cash that support beekeeping sectors and beekeepers to lend credit for confidently for their honey production Belets and Birhanu (2014).

Access of appropriate extension Service

Extension service is the activity that could be given to the urban beekeeper households and cooperatives who involved in urban beekeeper or not. This service includes technical advice, regular follow up, training service, trial and demonstration for new urban beekeeper participant households and member of urban beekeeper cooperatives. This study hypothesized that there is a positive relationship between extension service and urban beekeeping activities.

Beekeepers access to extension service and knowledge transfer from extension expert and nongovernmental organization is very critical for apiculture development practices and sustainability of beekeeping.

Access to swarm

It is a dummy variable (1= Yes 0=No) which is used to measure whether urban beekeeper households has access of swarm for their increasing of hives and its products or not. Apiarists getting market access to buy the swarms in a way easy with a reasonable and fair market price for their product maximizing, consumption and generating more income for their household food security. This study supposed that there is a positive relationship between accesses of swarm for urban beekeeper households to produce more for their consumption and income from sales of it. According to Soresa and Nigusa (2020) to sustain and start beekeeping availability of swarm resource by any means is very critical. The common establishing apiary mechanism is by catching the swarm from the locality, by gift and transfer from parents and families and buying it.

Use of printed wax foundation

It is a dummy variable for modern/frame hives that modern hives beekeepers are using wax foundation for their hive 1 yes, otherwise no 0 for the question of urban beekeeper households. The expectant result hypothesized that have positive relationship between the improved (modern hives) and use of wax foundation.

Printed wax foundation sheet is used for the recent type of hive (modern hive) and it believing, has the potential to be an excellent in higher yield and better quality of honey production

capacity than traditional and transitional types of hives. The problem is it needs centrifugal extractor to extract pure honey from its crude (Caroll, 2006).

Presence of polluted water in the city ecology

This is a dummy variable (0=Yes 1=No) it is used to measure whether the urban beekeeper household heads apiary sight has not to access pure water for their bee swarm or not. For beekeeping water is an important physical capital to obtain higher hive production amount. According to (FAO,2020) to establish apiary ensure for the bees access of safe waters sources.

Table 3.4: Explanatory variable description and its expected signs

Explanatory variables	Nature/types of variable	Description of variables/measurement unit	Expected signs
Dependent variable (Urban apiculture Y)	Continuous	Volume of honey products in kg	
Independent variables X			
Sex of household head (SHH)	Dummy	1 is male, otherwise 0 for female	$+ve$
Age of households head (AHH)	Continuous	Age of household head in year	$+ve$
Family size of household (FSHH)	Continuous	Total number of households	$+ve$
Apiary land size of the household (ALSHH)	Continuous	Year	$+ve$
Use of printed wax foundations (UPWF)	Dummy	1 for Yes, 0 for No	$+ve$
Types of hives used (traditional, transitional and modern hives)	Continuous	No of hives: traditional, transitional and modern hives	$+ve$
Access of Credit for apiculture business	Dummy	1 for Yes, otherwise0 for No	$+ve$
Frequency of extension service contact for apiculture (FECF)	Continuous	Frequency of extension contact per year	$+ve$
Long interval of hive inspections (HINI)	Continuous	Frequency of internal and external hive inspection	$-ve$
Presence of polluted water in the city (POPW)	Dummy	0 for Yes, otherwise1 for No	$-ve$
Access of better price of honey (BPOH)	Continuous	Current price of honey/kg	$+ve$
Access of swarm (AS)	Dummy	1 for Yes, 0 for No	$+ve$
Experiences of urban beekeeping	Continuous	Number of years	$+ve$

Source: Own construction hypothesis table (2021)

Table 3.5: Explanatory variable description and its expected signs for HFIAS

HFIAS	Nature/types of variable Categorical	Description of variables/measurement unit (Household food insecurity access scale) score	Expected signs
Independent variables			
Sex of households head (SHH)	Dummy	1 is male, otherwise 0 for female	$+ve$
Family size of household (FSHH)	Continuous	Total number of households	$-ve$
Age of households head (AHH)	Continuous	Total year of beekeeping	$+ve$
Education status of household head (ESHH)	Continuous	Level of education status	$+ve$
Use of printed wax foundation (UPWF)	Dummy	1 for Yes, 0 for No	$+ve$
Types and no of hives used (traditional, transitional and modern hives)	Continuous	No of hives: traditional, transitional and modern hives	$-+ve$
Access of credit service for apiculture (ACSAP)	Dummy	1 for Yes, 0 for No	$+ve$
Experience of urban beekeeping and management (EUBM)	Dummy	1 for Yes, 0 for No	$+ve$
Price of honey (PH)	Continuous	Current price of honey/kg	$+ve$
Apiary land type (AL type)	Dummy	0 for Private, otherwise1 for rental	$+-ve$

Source: Own construction HFIAS hypothesis table (2021)

CHAPTER FOUR: RESULT AND DISCUSSION

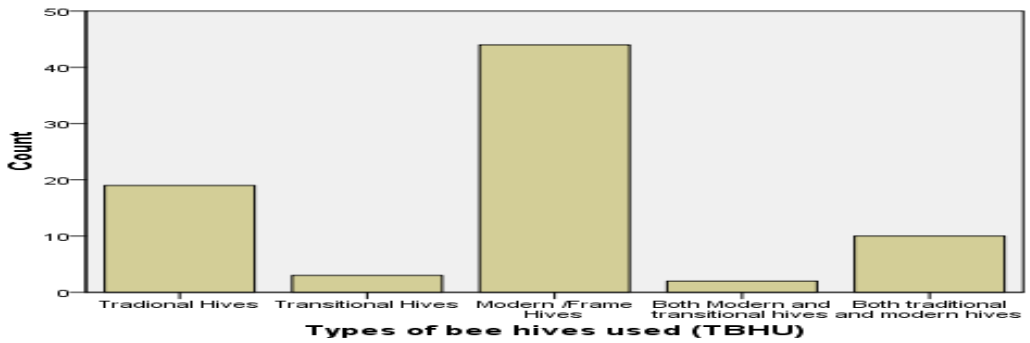
4.1. Urban Apiculture Practices

Beekeeping is one means of earning household income and supporting food access. Hence urban apiculture practiced in the study area is as a side business with other income generating activities. Most of the urban beekeeper households in the study area were engaged in petty trade, civil servants in governmental and private sector, craft work, crop and vegetable farming, dairy and poultry farming, daily labor works, guard and so for their livelihood sector from the survey and continuous observation evidences. Therefore, based on the study results, there were no any respondents who base their livelihoods only in the urban beekeeping sub-sector. As a result there are multiple of income source of urban beekeepers, accordingly.

4.1.1. Hive Types

Modern frame hives are the most commonly used type of hive in the sub-city, accounting for 56.4 percent of the total sample taken (Figure 4.1). Traditional hives are the second most common hive type, accounting for 24.4 percent of total sample results and field observation evidence. According to information from development agents at the sub-city and woreda levels as well as field observation evidence, beekeepers are more willing to employ improved hives. The transitional hive production method is one of the most underutilized types of hive production.

Traditional hive distribution by household is such that there is a minimum of 1 and a maximum of 6 per household. The number of traditional hives with a mean and standard deviation per household was 2.18 and 1.249, respectively. The minimum, maximum and total number of modern hive type is a 1, 32, and 235 on the sample respondents.



Source: Own survey data computed (2021)

Figure 4.1: Types of hives

4.1.2. Scale of Urban Beekeeping Operation by Hive Type

According to the survey results (Table 4.1), urban beekeepers' hive type and colony holding size ranged from 1 to 61 for traditional hives, 1 to 14 for transitional hives, and 1 to 32 for modern hives.

Table 4.1. Hive distribution by households

Types of hives	N	Minimum	Maximum	Sum	Mean	Std.
Traditional hives	28	1	6	61	2.18	1.249
Transitional hives	6	1	4	14	2.33	1.211
Modern hives	57	1	32	235	4.12	4.736

Source: Own survey data computed (2021)

4.1.3. Honey Yield by Type of Hives

Modern hive type: Well managed modern hive can produce crude honey from 30 to a maximum of 40 kg/hive/year.

Transitional hive type: The average yield of crude honey from transitional hive is 19kg/hive/year, and with better management system and forage potential the produce can range up to 25kg/hive/year.

Traditional hive type: It is the second widely a practiced type of hives in the study area, and it is estimated to have an average yield of 8kg crude honey/hive/year.

Based on Yibrah (2018), traditional hives production capacity is 5kg of crude honey/hive/year. Transitional or the intermediate (Kenyan top bar and Tanzanian zander type of hive) can produce about 7-8kg crude honey/hive/year. The improved one (Modern frame hive type) can produce about 15-20kg extracted honey/hive/year.

The descriptive result is supported by the empirical reviews that taken from building urban resilience assessment for urban and peri-urban agriculture in Addis Ababa (UNEP, 2014) founds that an average production potential of 40kg honey/improved hives/year that of two fold of rural side improved hive annual honey production potentials and the city has annually 60 tons of honey production potential. From annual post-harvest reports of Kolfe-Keranio sub-city urban agriculture office 8.5 tons of honey can be produced at sub-city within total of 15 woredas under the sub-city. Based on Kassa et al (2017), households who used traditional hive type can obtain about honey that is supplied to market increased by 15.3%, and those households who practiced both modern and traditional beehives can supply a volume honey increased by 29.5%.

4.1.4. Annual Honey Yield and Income

The urban beekeeper annual income from honey was the sum of net income after financing all expenses of family labor, hive maintenance, professional and apiary rental and other urban beekeeping associated costs.

The descriptive result and information obtained from woreda to the city level urban agriculture office the total annual production of the sub-city is 8.5 ton of honey (sub-city urban agriculture office, 2020); while there is no record of production of other products.

From the sample taken apiarist households 7,303kg (7.3 tons) of honey was produced and almost no production of wax and other products in the sub-city. Most of the sub-city apiarists did not have awareness and skill to produce hive products other than honey, and also they did not have complete hive production materials (accessories). According to the survey results, out of 7,303kg total honey yield about 1,448kg of honey is used for household consumption. The household consumed honey in the sub-city covered almost 19.83% of the total production of honey see (Table 4.2). The result of this study agree with Teklu and Dinku (2016), as they stated that beekeepers practiced as sideway business with other agricultural activities in Gedeo zones of southern Nation nationality and people's regional state.

Table 4.2. Annual honey yield and obtained income

	N	Maximum	Sum	Mean	Std.
Annual honey supply for sale in kg	73	420	5,855	80.21	96.31
Annual consumed honey in the household in kg.	78	120	1,448	21.13	17.71
Annual income obtained from sales of honey in Eth. Birr	78	42000	1,139000	14602.7	12723.6

Source: own survey (2021).

4.1.5. Honey Market Assessment

According to the FGD discussion and key informant interview, there is a high demand of domestically produced honey in the study area. This is due to the trust of no adulteration. Most beekeepers in the study area enjoy honey price ranging from 200.00 to 450.00 ETB per gk. As indicated in the figure 4.2, the mean price of honey in th e rea is 302.05 ETB/kg. Most of the study area beekeepers were selling their honey to collectors at household level with the price set by them.

The total honey production of (2021) in the study area was 7.3 tons; of which 1,448kg was consumed domestically and 5,855kg was sold at household level with a total value of 1,139000 ETB (Table 4.2).

Domestic honey price mainly in the study area and Addis Ababa city differ substantially by honey marketing shop, super market and domestically produced honey. During the study period, information on the average price of honey in the city honey selling shop and supermarket was about 200-300 ETB. Whereas, the highest price for domestic produced honey was observed to be 200-450 ETB.

The findings indicate that, the urban apiary farmers' gate price was greater than the market honey price in the period April 2021 through end of July2021, reaching a maximum level of 300 ETB/kg in the honey marketing shop and supermarket.

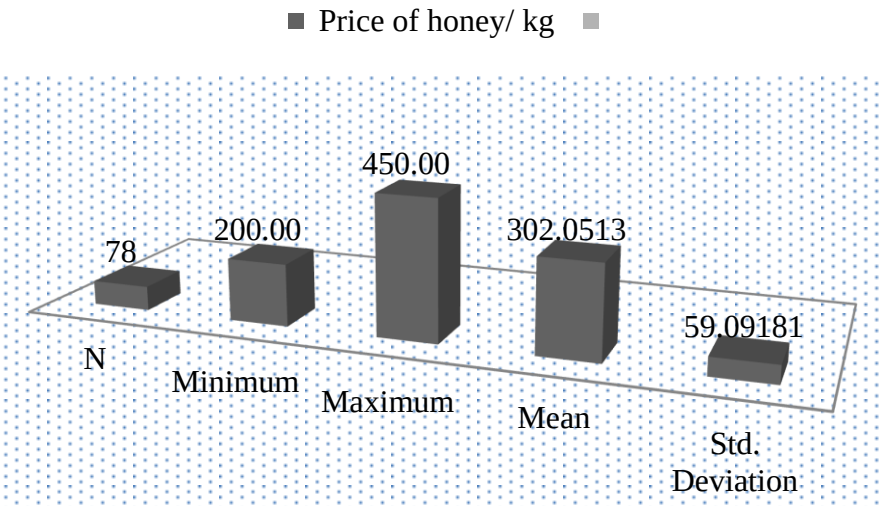


Figure 4.2 Price of honey

4.1.6. Stakeholders Impact Assessment

Small scale urban beekeeping is created by considering, financial capital, human capital, urban beekeeping space, skill and knowledge, physical capital and other important apiary inputs at the value of their proper opportunity costs. To achieve in this sub-sector, there is a need of interventions in urban beekeeping business, from urban governments. In return, the city government benefited from increased volume of honey production and sales tax. The tax revenue can be obtained from urban beekeepers that are taxed based on their honey sell income. In addition, beekeeping create job opportunities for carpenter (who made hive and hive input) and the city administration again benefited double from collecting tariffs from sales of inputs that are necessary for apiary production. Apiary inputs includes box hives, wax printer mold, honey extractor, queen excluder, smoker, veils, total, bees, gaunt, wax, queen cage and other important input. For further information refer table 4.3 bellow.

Table 4.3 Urban beekeeping stake holders

Stakeholders	Roles
Urban beekeeper households	Hobbies, skill and capital
Ministry of agriculture	Formulate workable urban beekeeping police and strategy
City farmer and urban agriculture commission	Formulate workable strategy, package, facilitate apiary input (land, colony, credit, technology, training center etc.)
Research centers	Release urban apiary fit technology and docile bee swarm.
Urban community	Understand bees characteristics and take the necessary care
Nongovernmental organizations	Support the sector by funding it with the necessary skill up training
Sub-city farmer and urban agriculture office	Coordinate and facilitate all inputs for urban beekeeping achievement by assigning professional extension experts
Woreda urban agriculture office	Support with continuous follow up and skill training.

Source: own survey (2021).

Having the entire findings and proposed point of view urban beekeeper household in the study area, who obtains five (5) and more number of improved (modern hive) was can get mean of 30.62kg/hive/year. This multiplied by mean price of 302.05 ETB/kg (30.62kg/hive/year ×5 improved hives =153.1 kg/year). Then, the annual revenue is estimated to be about 46,243.86 ETB/production season. The mean expense of these associated activities is about 4,116.42 ETB/year. Then, the net return of such scaled apiary business can be about Birr 42,127.44 ETB)/ year.

Therefore urban beekeeper household, who obtained minimum 5 modern hives with self-proper apiary management knowledge and by incorporating all the necessary inputs can earn more than what is estimated due to adoption of improved technologies. This scenario implies that urban beekeeper household with above preconditions can improve their household food security.

Table 4.4. Honey yield by types of hives

Types of hives	Minimum kg/year	Mean kg/yea	Maximum kg/year
Modern hives	10	30.62	40
Transitional hives	10	19	25
Traditional hives	6	8.13	12

Source: own survey (2021).

4.1.7. Descriptive Statistics Results

Sex of sample household heads

From the dummy variables, the sex distribution of urban beekeeper households were 69.2% (54) were male headed and the remaining 30.8% (24) were females' urban beekeeper households (Table 4.5). The finding shows that, the urban beekeeping activity in the sub-city was dominated by male respondents. However, the t-test result indicated (p= 0.0000) that there was a significant relation with urban apiculture practice and both sex of household head. Considering that with male dominance issue, this study finding was confirmed by Amina (2019) found majority of beekeepers were males (71.0%) and (29%) females which support the current result and also this result is in lined with Alemayehu and Abera findings (2017) that found 68% of beekeepers are male household head and 32% were female headed.

From key informant interview a male extension worker said that "the problem is the back ward thinking of the society that not yet worked on it from the beginning and still going on us. Some women are better apiarist than males because they continually supervised and clean their apiary than man". Therefore urban beekeeping practice is male dominance activity like that of country side beekeeping. The reason explained from focal group discussion for male dominancy is "majority of females are psychologically neutralized themselves and saying that beekeeping is males job even by connecting their dressing styles and sting fear" said the male group member. The female group participant said that "males are strong and fearless to fit the challenges than females and also sting tolerable than females" she said.

Use of printed wax foundation (UPWF)

This is the main input of improved frame hive to increase production amount of honey and found to be affects positively and significantly urban apiculture practice at 1% (P=0.0000) level of significant. Hence, the more use of improved bee hives within use of printed wax foundation could increase the ability of the urban apiculture production and productivity; then tend to produce more amounts of hive products.

Credit service to urban apiculture

The access of credit service for the purpose of urban apiculture small scale households affect significantly at (t-test= 8.4841 and p= 0.0000) on urban apiculture practice, which implies that urban apiculture household heads who had chance to credit services have a probability of more hive product yield gain. More over this finding in line with Adino and Tessema (2021) access of credit service for beekeeper households has a significant positive effect. Credit access has an ability to minimize the financial limitation of beekeeper households that enable them to buy and use improved technology and inputs for their apiary Dereje et al (2020).

Problem of polluted water in the city ecology

The most important problem presented in the study area was polluted water that negatively affected urban beekeeping and its production amount. This problem is directly connected with the ecology of the urban that increasing release of untreated water with open canalization in the study area. As the statistical test result show (t-test= 8.5721, p= 0.0000) there was at 1% significant level.

Access of swarm

It was a positive relationship between accesses of swarm for urban beekeeper households to produce more for their consumption and income earning from sales of it. To start and expand the apiary beekeepers source of their swarm / honey bee colony and accessibility is to important. As the model result indicates access and sources of swarm was positively and significantly affected the urban apiculture practice at 1% (p=0.0000) probability level. The result is supported by the study of Amsalu (2020) the swarm source and availability to important for beekeepers to start and sustain beekeeping in the study area.

Table 4.5. Test statistics for continuous –dummy variables (T-test)

Types of variables	Number of observation		Combined		T-value	P-value
			Mean	Std.		
Sex (SHH)	Female	24	46.03	80.41	8.5108	0.0000***
	Male	54				
	Total	78				
Use of printed wax foundation (UPWF)	Yes	64	45.86	80.50	8.5421	0.0000***
	No	14				
	Total	78				
Access of credit service for apiculture	Yes	50	45..69	80.59	8.5735	0.0000***
	No	28				
	Total	78				
Presence of polluted water (POPW)	Yes	76	46.17	80.33	8.4833	0.0000***
	No	2				
	Total	78				
Access of swarm (AS)	Yes	68	46.17	80.33	8.4833	0.0000 ***
	No	10				
	Total	78				

*Note: ***, **,*, show significance at p<0.01, p<0.05, and p<0.1 respectively.*

Source: Own survey data computed (2021)

4.1.8. Descriptive Statistics of Continuous Variables

Age of households head (AHH)

The regression results age of urban beekeeper households was positively significant at 1% (p=0.0000) significance level. This result implies that aged of households increase practice and production yield of urban apiculture positively affected. This suggests that aged and retire urban dweller spend their spare time on urban apiculture practice to support their household food

security and income earning. Further the aged people have more social networks tendency than younger peoples to lead their apiary patiently and appropriately using this industry. But this result was in opposite way that of Amsalu (2020) study results in the rural area that he was stated beekeepers in his study area more successful at their productive age.

Apiary land size: Is more important socioeconomic variable that has a promoting chance of urban apiculture production in the city. In the urban ecology landholding size was very limited access and expensive to rent it, even if the urban landholding amounts plays a significant role for the small scale urban apiculture practice and other urban agricultural activities to support household food security and reduce urban unemployment and poverty. As the statistical correlation test shows in (table 4.6) that significance value of (p= 0.0000, correlation coefficient of 0.652***) and this value indicates apiary land size has a positive effect on their amount of hive products and household food security. According to Nasir et al. (2020), land holding size of the household importantly and significantly plays a great role on agriculture productivity and at the end household livelihood situation.

Types and number of bee hives used: From the correlation analysis result, number of traditional hives (TRADHIVE) as compared to transitional (TRANHIVE) and modern (MODHIVE) hives the (correlation coefficient test = -0.0973 p= 0.0005). The analysis result implies that there is a negative correlation and increasing its amount at decreasing rate only its amount of production increase with increased hive number. But the amount per hive is significantly indicates at decreasing level of production amount with compared to transitional and modern hives production potential.

Improved framed hives (MODHIVE) is affected quantity of hive (hone) yield positively and significantly as shown in (table 4.6). The statistical correlation tests significant at (correlation coefficient of 0.932*** and p= 0.0000) significant level. The result implies that use of improved frame hives leads more quantity production than other types of hives. Because modern hive is simple to colony management and apply of technological equipment those support to get higher yield of hive products. According to Kassa et.al (2017) confirmation modern hives has a positive effect on increase amount at 1% significance level.

Extension contacts of urban beekeeper (FECF): From the descriptive analysis result in the (table 4.6) frequent extension contact and follow up for urban beekeeper was determine the production amount of hives at positive significance at (correlation coefficient 0.853*** and p=0.000) value with the level of 1%. Based on the result it is possible to conclude the appropriate extension agents frequent contacts and follow up of urban beekeeper is the most significant to produce potentially and increase households food security reasonably. This finding in lined with the study findings by Biruk (2014) continuous development agent contact and technical support to beekeeper make the beekeepers to have better exposure and more quantity of honey producer.

Long interval of hive inspection (HINI): In beekeeping practice regular internal and external hive inspection can increase the production and productivity of hives. It should be done with a short and regularly, otherwise it negatively affects the potential hives production. As this study result shows (table 4.6) long interval of inspection in the study area was negatively affecting at (correlation coefficient -0.340** and p= 0.0585) level of significance. This result suggests that long interval of internal and external hive inspections increasing production at decreasing rate. This finding agrees with Teklu and Dinku (2016) that stated most beekeepers about 72% on their finding were do not inspect their hives regularly.

Experience of urban beekeeping (EUBM): Beekeeping experience played a great role and a positive relationship between apiculture business and management. To expand the apiary and produce more the beekeepers experience to manage properly their swarm / honey bee colony an important factor. The statistical correlation results showed that urban beekeeping experiences positively and significantly affected quantity of hive yields at (correlation coefficient of 0.646*** and 0.0000) significant level. This result implies that, as urban beekeeper household's year of experiences increases the quantity of hive production. This result is confirmed by Kassa et al. (2017) that beekeepers who have more experience in beekeeping have higher ability to produce more quantity of hive products than who have no experiences of beekeeping.

Table 4.6. Test statistics of characteristics for continuous variables (correlation and significance test)

Types of variables	Measurement	Urban apiculture (UAP)	Age of household head (AHH)	Apiary land size of households (ALSH)	Traditional hives (TRADHIVE)	Modern hives (MODHIVE)	Frequency of extension contact & follow up (FECF)	Experience of urban beekeeping (Experience)
Urban apiculture practice (UAP)		1.0000						
Age of household head (AHH)	Pearson correlation	0.232*	1					
	Sign.	0.0000						
	N	78						
Apiary land size of households (ALSHH)	Pearson correlation	0.652***	0.292**	1				
	Sign.	0.0000	0.0076					
	N	78	78					
Traditional hives (TRADHIVE)	Pearson correlation	-0.0973	-0.169	-0.142	1			
	Sign.	0.0005	0.0087	0.1179				
	N	78		78				
Modern hives (MODHIVE)	Pearson correlation	0.932***	0.310**	0.627***		1		
	Sign.	0.0000	0.0000	0.0000	0.0002			
	N	78	78	78	78			
Frequency of extension contact & follow up (FECF)	Pearson correlation	0.853***	0.157	0.624***	-0.0295		1	
	Sign.	0.0000	0.0043	0.0000	0.1754	0.0000		
	N	78	78	78	78	78		
Experience of urban beekeeping (Experience)	Pearson correlation	0.646***	0.141	0.352**	0.0866	0.586***	0.497***	1
	Sign.	0.0000	0.0453	0.0018	0.5566	0.0001	0.0000	
	N	78	78	78	78	78	78	

*Note: significance at * p<0.05, ** p<0.01, *** p<0.001 respectively.*

Source: Own survey data computed (2021)

4.2. Opportunities and Challenges of Urban Apiculture

4.2.1. Opportunities of Small-Scale Urban Beekeeping

The presence of urban beekeeping interested society group in the city, availability of a plenty bee forage and water, high demand and market access for hive products, existence of swarms in the city and surrounding woredas, the presence of urban agriculture policy and movement and nearby beekeeping equipment inputs are the important opportunities for urban apiculture business enterprise.

Table 4.7. Some important opportunities of urban beekeeping

Variables	Response	Response frequency	Percentage
Availability of forage	Excellent	17	21.8
	Very good	38	48.7
	Good	23	29.5
	Total	**78**	**100**
Availability of water	Yes	76	97.4
	No	2	2.6
	Total	**78**	**100**
Market customers for honey	Individuals	56	71.8
	Only for consumption	22	28.2
	Total	**78**	**100**
Access of swarm	Yes	68	87.2
	No	10	12.8
	Total	**78**	**100**

Source: Own survey data (2021)

4.2.1.1. Urban Beekeeper Societies and their Hobby

Most of small scale beekeeping households in Kolfe-Keranio sub-city are so eager to increase their beekeeping products. The greater numbers of beekeepers were keeping their bees to improve their household food security to earn income. All the respondents (78) were answered "yes" about urban apiculture supportive contribution for their household food security (consumption) and income generation. 59% (46) respondents were involved in urban beekeeping production as a hobby. This survey results indicate that, their self-motivation is how much high to join the beekeeping industry and searching a way to improve their household food security. So there is a starting potential and probability beyond social resources (asset) to boost urban

apiculture industry to minimize food insecurity of urban poor households. About 37.2% (29) of the respondent households were saying they learned from their families and parents. The only 2.6% (2) respondents were started keeping by aid of training. The left 1.3% (1) learned from other sources.

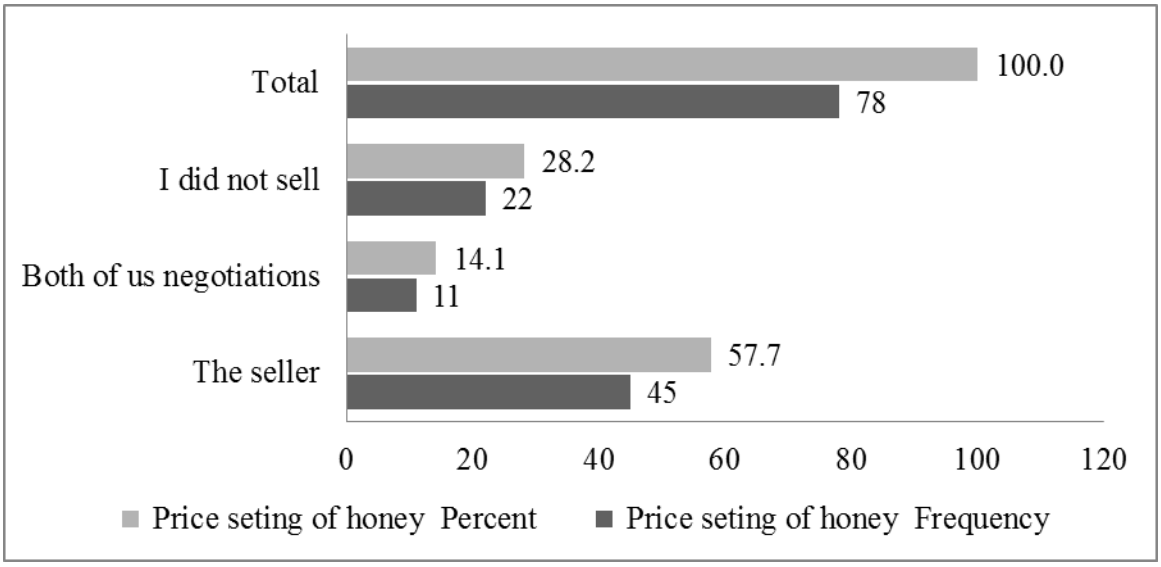
4.2.1.2. Availability of Bee Forage

Concerning physical (Natural) capital: Different studies show that to perform effective beekeeping, natural resources such as bee swarms, bee forage availability, clean water access, environmental resource and an apiary place to keep the bees are the critical issues to promote the sector and to increase hive products. According to the revised master plan of Addis Ababa city administration more than 22,000 hectare or 41% of the city land reserved for urban green frame and more than half (12,5000 hectares) foreseen forestry Horst, A. (2006).

4.2.1.3. Honey Demand and Market Access

Hive products mainly honey and bee waxes demanding highly for cultural and religious life of the societies from rural to the urban. The price of honey during this study is 450 ETB/kg at a maximum price level; 302.05 Eth. Birr/kg on average price, and 200 ETB/kg at a minimum price level for both pure and crude honey. In this densely populated urban area there is no considerable cost of transport and no problem of physical barriers to access hive product markets, no lack of negotiating skills and confidences, and no lack of market information as that of rural beekeepers.

Concerning marketing of honey (Price): Based on the survey result and focus group discussion the most urban beekeeper households were price makers for their honey products because of a limited amount of honey production and less access for the market in the study area. About 57.7% (45) respondents were set their honey selling price and 14.1% (11) were set their honey price by negotiations. The remaining 22.8% (22) urban beekeepers were not selling their honey; instead they consume it in the house (Figure4.4).

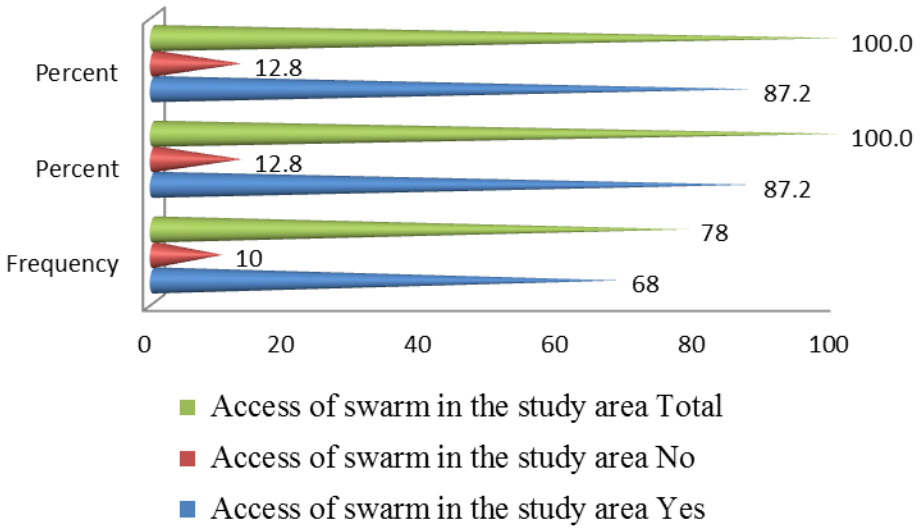


Source: Own survey data (2021)

Figure 4.3 The way in which the price of urban beekeepers honey

4.2.1.4. Access of Swarm

Honey bees swarming is the obvious means of reproduction mechanism. From total of 78 respondents in the study area, about 87.2% (68) said "yes", they do have an access of swarms and 12.8% (10) respondents were reacted by say "no access of swarm" in their locality and surrounding rural woredas. For the concerns of swarming occurrences in the study area 98.7% (77) respondents were say "yes there is swarming in the locality" and only 1.3% (1) respondent was reacted oppositely "no swarming occurrence in the locality" of the residences. According to the beekeeper household heads response the bees swarming seasons is twice a year. Most of the respondents 74.4% (58) said from March to May, the second groups 24.4% (19) said September to October and the mediator was 1.3% (1) said both seasons march to May and September to October. Teklu and Dinku (2016) the issue of swarming had the advantage to increase the number of households colony size /number of colony and replace nonproductive colony in the apiary.



Source: Own survey data (2021)

Figure 4.4 Access of swarm

4.2.1.5. Existence of Urban Agriculture Movement

There are established urban agriculture institutions to give service for the provision of extension support to urban small scale household producers who resource-poor. And, there is urban agriculture policy and strategy to support urban farming activities. It works with urban poverty reduction and food security initiatives movement by using open space and private piece of land plot to grow vegetables and livestock at small scale level in the city of Addis Ababa. Urban farming activities include resource-poor subsistence home gardening and commercial agricultural enterprises. According to Messay (2012), urban and peri-urban farming activities include urban apiculture, horticulture farming, agro-forestry and aquaculture.

4.2.1.6. Existence of Pesticide Free Urban Environment

Because of less cereal crop cultivation lands in the city and no application of pesticides for pest controlling purpose, the bees are sheltered in the city from different insecticide chemicals that applied in the countryside. According to a guide to urban beekeeping, because of the urban ecological and sanitary reason, the application of chemical spray in the urban areas is often very less than that we find in countryside and agricultural zones. So the city and urban ecology can be

a safer and healthier environment for bees and beekeeping production than certain agricultural ecosystem where the application of pesticide is endemic.

4.2.3. Challenges of Small Scale Urban Apiculture Enterprise

It is obvious that the major constraints of apiculture are varied according to its keeping place and ecological conditions. And, the challenges differ based on the scales and types of business enterprise carried out. In this study, the urban apiculture small enterprise main constraints were assessed by classifying as social, economic, institutional and physical resource constraints. According to Haftey et al. (2018), challenges of apiculture were lack of skilled man power, high cost of bee hives, Lack of government involvement, shortage of bee forage and pest and pray of honey bees were the major constraints of beekeeping in Ethiopia.

4.2.3.1. Lack of Apiary Management Skill and Knowledge

A human capital is very critical issue for urban beekeeping, as the urban environment is densely populated and is associated with noise of bees' movement to the surroundings of the apiaries to search of forage and water for their honey production.

From the observations and interviews, traditionally some societies of the study area have less awareness to bees management. From urban beekeeping skill check responses, 65.4% (51) said "yes" as having little skills to manage their apiary by themselves. The remaining 34.6% (27) beekeeper households gave "no" response as they do not have skill to manage and inspect their colonies by themselves. Too many urban beekeepers have no comprehensive skills that they are using in wrong way or outdated management technique. Specifically, for internal hive management (inspection and production), 55.1% (43) were inspecting themselves; but, most of them were supported by professionals with high professional labor cost from amounting to 500-1000 Birr/hive, currently. The remaining 44.9% (35) beekeeping households were having no skill at all and used to manage their hives by paid professionals.

Concerning the source and access of training for urban beekeeper households, 98.7% (77) said "no" appropriate training access given from government institutions or from non-governmental organizations to urban beekeeper households. Only one beekeeper got access of appropriate beekeeping management training.

In terms of social networks, there is difficultly of searching beekeeping professionals in the city. According to focal group discussions, a woman group participant said "…urban beekeeper households face a challenge of searching responsible bee professionals when needed. Also, we cannot get skilled professional within the city to call for support while harvesting or post-harvest operations." The analysis is consistent with the article of Haftey et al. (2018) that stated beekeeping sub-sector is suffered and being suffering from lack of skilled man power, appropriate and adequate training and regular extension follow up for beekeeper households.

4.2.3.2. Economic Capital Challenges

Almost all 96.2% (75) beekeeper households were keeping their bees in small plot of backyard land, on their top of buildings, on fence wall or their house wall. High cost of hive and its equipment, high cost of swarm inputs and honey harvesting and hive management professional costs are vital challenges of the apiculture enterprise in the study area (see table 4.8 for detail beekeeping economic challenges). Moreover, lack of smallholder urban beekeeper household's access to finance contributes to inhibiting the production of their hives.

High cost and limited use of improved hive technological equipment is also one of the major challenges that are affecting urban apiculture promotion as well as potential production. As a result, small-scale urban beekeeper households were depending on traditional and backward beekeeping systems in the study area. Improved apiculture equipments include box hive, casting mold, frame wire, queen excluder, honey extractor and smoker are the major technological inputs. According to Yibrah (2018), high cost of beekeeping technologies and lack of access to finance were highly affecting the adoption of improved technologies for honey production.

Table 4. 8. Cost of apiary inputs

Variables	Minimum	Maximum	Mean	Std. Deviation
Price of swarm (Eth. birr)	500.00	2500.00	1512.16	494.26
Traditional hives price (Eth. birr)	30.00	150.00	82.30	27.03
Transitional hive price (Eth. birr)	700.00	3000.00	2406.00	472.25
Modern hive price (Eth. birr)	2000.00	4000.00	3436.06	324.56

Source: Own survey data (2021)

4.2.3.3. Absence of Urban Apiculture policy and Workable Strategy

Policy, institutions and process have direct impact on urban apiculture production and productivity. The majority of urban beekeeper household respondents were complaining about ineffectiveness of government policy in urban apiculture sub-sector. According to key informants justification in the sub-city urban apiculture sub-sector from the government side there is very little or almost no involvement of official leading institution in support of urban apiculture.

The major challenges of the extension services of beekeeping are: lack of inputs (bee hives, honey extractor, quality protective clothes, smoker, casting mold) from market, lack of credit, lack of market for wax, etc. Key informants complain over some beekeeping cooperatives. Their criticism government was on supply of apiary land for cooperatives. "The malpractice of the cooperative members who did not use their apiary land that was allocated for the purpose of beekeeping, instead of that they transfer for other activities by selling or transferring or renting the apiary land or they used it to build houses by the members. So this type of unethical behavior of some urban beekeepers negatively affects the chance of other innocent urban beekeepers and the urban beekeeping industry as a whole. Mulesa and Fekadu (2017) use of full package improved beekeeping technological equipment, building practical skill up training on beekeeping, availing strategies to support beekeepers with credit and input facilitation are important to promote beekeeping industry.

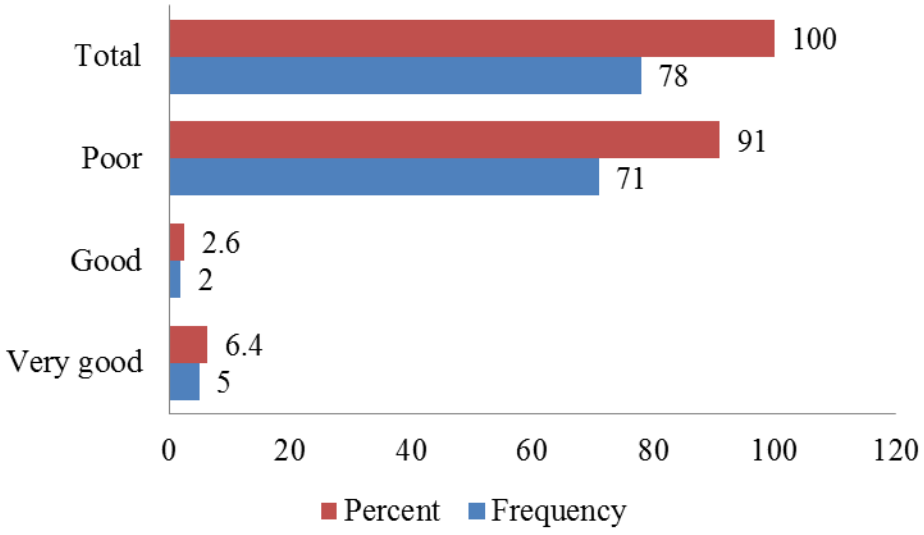


Figure 4.5 Government service indicator graph

Source: Own survey data (2021)

4.2.3.4. Lack of Credit Service to Urban Apiculture

Economic challenges of urban apiculture practice: Access to finance, apiary land, income/access to market and access to financial networks (producer and market association) are of great significance in beekeeping practices. The analysis results show that 97.4% (76) of urban beekeepers were having no access to credit service from governmental or any other financial sources. The only 2.6% (2) were having access of finance for their apiculture business in the sub-city. Almost all apiarists were leading their production activities with the limited land space around and on the top of their buildings.

4.2.3.5. Lack of Beekeeping Equipment

At continuous observation and supervision of the data collection time the highest number of urban beekeeper households were not used full beekeeping management equipment and improved hive full accessories. Major physical constraints that affect urban beekeeping sector in the study area were lack of beekeeping knowledge how to place the hive and preparation of apiary hive installation. From all sample sampled urban beekeeper households no one has full equipment of their hive.

Their justification at the focal group discussion was expressed as "we did not know all types of improved hive equipment and on the other way we cannot buy it because of financial limitation and high cost of the equipment". The other female participants in the discussion was disappointed and justify some equipment costs by said "for example the current cost of casting mold and honey extractor costs more than 6000 and 10,000 ETB. birr respectively, so how could we afford it?" she said.

For effective beekeeping business improvement and to achieve maximum hive products (honey and wax) beekeepers should be use improved beekeeping technologies, Biruk Deribe (2014).

4.2.3.6. Absence of Laboratory Facilities; Testing Center for Quality and Adulteration

Due to improper use of honey harvesting equipment and apiary sanitation, honey becomes susceptible to contamination. Some unethical honey distributer and seller used to make adulteration of honey to conduct illegal business practice. As a result of no honey quality testing center and laboratory in the country level, low quality and adulterated honey easily entered into the formal market chain and being used by consumers. Absence of honey harvesting equipment and honey container sanitary also affect the consumers trust to freely demanding it.

4.2.3.7. Lack of Established Market Network

There was no well-established market for honey in the city and study area. During focus group discussion, the participants confirmed that honey is the most adulterated food item in their residential area and Gojam berenda surroundings. Most illegal honey distributers ask to buy with a high price (more price than market), suspecting that, they use the pure honey for adulteration purpose. They do not buy extracted honey. This indicates that the crude honey wax float used to make similarity with the organic honey for their adulterated products.

4.2.3.8. Extraction, Packaging and Standard Products

Some beekeeper households extract their crude honey by using private, group and sub-city farmer and urban agriculture office honey extractor equipment. But, most of the urban beekeeper households do not use. They used to sell their honey as it is in crude honey form. In the study area, there is no one urban beekeeper households who practice honey packaging and producing

standard quality honey products. They simply process locally using sieve and separating it from combs. At the end of honey harvest comb selection and separation is done in most beekeepers to eliminate pollen and pieces of dry wax and comb Bett (2017).

4.2.3.9. No Production of Wax, Royal jelly, Venom and Pollen

Almost all the urban beekeeper households do not know about the production and business of royal jelly, venom, pollen grain, propolis, colony and wax. Partially, they know about wax product advantage but they did not produce it.

4.2.3.10. Bee's Predator and Pests

Urban beekeepers complained for bees' predators, i.e., bees eater birds, ants and wax moth in the city. Some part of the study area confirmed that bee eating birds (meropidae) decreased their colony size and honey production. Wax moth (galleria mellonella) is the most affecting honey bee pests in the study area.

According to Dinaol etal. (2016), the effect of pest and predator occurs in seasonal variation. These pest and predators effect was ranked, and bee eater birds, ants, wax moth, spider and honey badger are important, respectively.

4.3. Determinants of Urban Apiculture Development

The study was conducted the critical and necessary model diagnosis test which include model specification test for overall such as goodness of fit, multi collinearity problem test and test of model specification error test. These all preconditions model test carried out before running the linear regression while model specification error tests or link test carried out after running the model.

4.3.1. Linear Models Regression Analysis

In this analysis, the dependent variable is household's total annual yield of honey, which is described by urban apiculture. In this section the multiple linear regressions indicates that the explanatory variables are found to affect the dependent variable (see Table 4.9).

4.3.2. Factors Affecting Urban Apiculture

This section provides the analysis of major factors that are affecting urban apiculture in small scale enterprise and explained by inferential statistical outputs related to Social, economic, institutional and physical explanatory variables characteristics. In this study, a total of 15 independent variables were selected and out of these, 9 of them revealed significance association with the urban apiculture production yield.

These variables include age of household, apiary land size, number of transitional hives, improved hives, frequency of extension contact, price of honey and experience of urban beekeeping are continuous variable, whereas use of printed wax foundation and access of credit service for urban apiculture are dummy variable that show statistically significant at 1%, 5% and 10%significant level with the urban apiculture yield. Sex, family size, number of traditional hives long interval of hive inspection, access of credit service and polluted water in the urban ecology do not have statistically significant relation with the urban apiculture yield. The descriptive analysis result and over all summary of this study is presented in table 4.5, 4.6 and 4.8 bellow.

Age of households head (AHH): As indicated in the table 4.9, the age of the household head is found to have statistically significant relation with (t=-1.74 and p=0.087) value, this implies that as age increased by one year the amount of honey produced decreases by 0.4667867 kilogram per hive. The aged household head who could not manage their apiary due to their over aged affect the production negatively as shown the value of (t= -1.74). According to Biruk (2014), younger age people involve on to become independent beekeepers and gradually they obtain their own apiary as well as they capacitate their knowledge and experience through practice and experience sharing from fellow nearby beekeepers. But this result was in opposite way that of Amsalu (2020) study results in the rural area that he was stated beekeepers in his study area more successful at their productive age.

In addition, Apiary land size of the households (ALSHH), Use of printed wax foundation (UPWF), Number of Transitional hives (TRANHIVE), Use of modern hive (NMHO), Frequency of extension contact & follow up (FECF), Access of better price of honey (BPOH), Access of

swarm (AS), and Experiences of urban beekeeping are vital variables explaining the volume and value of hone production at household level as indicated in the following table.

Table 4.9 Linear regression model estimates for urban apiculture practices/yield

Variables	Coef.	St. Err.	T	p-value
Sex of households head (SHH)	6.057984	6.897539	0.88	0.383
Family size of household (FSHH)	0 .0788999	2.158255	0.04	0.971
Age of households head (AHH)	-0.4667867	.268824	-1.74	0.087*
Apiary land size of the households (ALSHH)	0.1481746	0.070906	2.09	0.041*
Use of printed wax foundation (UPWF)	16.80898	7.880731	2.13	0.037*
Number of Traditional hives (TRADHIVE)	-3.1544	3.025437	-1.04	0.301
Number of Transitional hives (TRANHIVE)	13.02352	5.916418	2.20	0.031*
Number of modern hives (MODHIVE)	21.46177	2.430347	8.83	0.000***
Access of credit service for apiculture (ACSAP)	14.93933	28.08808	0.53	0.597
Frequency of extension contact (FECF)	14.62168	6.978931	2.10	0.040*
Long interval of hive inspections (HINI)	-3.323255	2.988599	-1.11	0.270
Polluted water in the city (POPW)	-3.798914	22.25893	-0.17	0.865
Price of honey (BPOH)	0.0826992	0.0492545	1.68	0.098*
Access of swarm (AS)	13.6523	7.175356	1.90	0.062*
Experiences of urban beekeeping	3.771274	1.098792	3.43	0.001***
-cons	-45.85588	39.67682	-1.16	0.252
Number of observations				78
F (15, 62)				60.33
Prob.>F				0.0000
R^2				0.9359
Adj. R^2				0.9204
Root MSE				549

*Note: ***, **,*, show significance at p<0.01, p<0.05, and p<0.1 respectively.*
Source: Own survey data computed (2021)

4.4. Factors Determining Urban Beekeepers Household Food Security

4.4.1. Description of Urban Apiculture and Household Food Security

The survey result as shown in table 4.10 indicates that about 67 (85.9%) of the total urban beekeeper household respondents were worried about having no enough food, and the rest 11 (14.1%) were not worried about having no enough food. Of 68 (87.2%) of the total urban beekeeper respondent households were found to be worried about having not able to eat balanced food kinds and on the other way the remaining 10 (12.8%) of them urban beekeeper household respondents were not worried for they are not able to eat balanced food kinds. About 68 (87.2%)

of the total urban beekeeping households were having limited variety of foods due to lack of resources. In the study area, 67 (85.9%) of the total urban beekeeper households have eaten unwanted food as a result of lack of resources to obtain other types of food and the rest 11 (14.1%) have not eaten unwanted food. The study result indicated that about 63 (80.8%) of the total respondent households eaten smaller food per day due to lack of enough food and the rest 15 (19.2%) respondent households did not eat smaller meal per day because of enough food in the study area. However, the average respondents have to eat smaller meal per days as a result of lack of enough food at least for one day per month. About 49 (62.8%) of the urban apiarist respondents, as shown in the table 4.10, have eaten less meal per day due to lack of food and the remaining about 29 (37.2%) of urban beekeeper households have not eaten less meal per day.

Table 4. 10. Household food insecurity access scale (HFIAS) measurement tool

No	Question	Urban beekeeper household heads		
		Count		%
1	In the past four weeks, did you worry that your household would not have enough food?	Yes	67	85.9
		No	11	14.1
1.1	If yes How often did this happen?	2		
2	In the past four weeks, were you or any household member not able to eat the kinds of foods you preferred because of a lack of resources?	Yes	68	87.2
		No	10	12.8
2.2	If yes How often did this happen?	2		
3	In the past four weeks, did you or any household member have to eat a limited variety of foods due to a lack of resources?	Yes	68	87.2
		No	10	12.8
3.3	If yes How often did this happen?	2		
4	In the past four weeks, did you or any household member have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food?	Yes	67	85.9
		No	11	14.1
4.1	If yes How often did this happen?	2		
5	In the past four weeks, did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?	Yes	63	80.8
		No	15	19.2
5.5	If yes How often did this happen?	1		
6	In the past four weeks, did you or any other household member have to eat fewer meals in a day because there was not enough food?	Yes	49	62.8
		No	29	37.2
6.1	If yes how many days within the month?	1		
7	In the past four weeks, was there ever no food to eat of any kind in your household because of lack of resources to get food?	Yes	6	7.7
		No	72	92.3
7.1	If yes How often did this happen?	1		
8	In the past four weeks, did you or any household member go to sleep at night hungry because there was not enough food?	Yes	1	1.3
		No	77	98.7
8.1	If yes How often did this happen?	0		
9	In the past four weeks, did you or any household member go a whole day and night without eating anything because there was not enough food?	Yes	0	0
		No	78	100
9.1	If yes How often did this happen?	0		

Source: Own survey data computed (2021)

4.4.2. Descriptive Results of Household Food Security Status Explanatory Variables Characteristics

Family size of household (FSHH): Concerning family size, the computed mean of family size for food secure and food insecure households was 3.88, 5 for mild food insecure, 4.86 for moderately food insecure, and 5.33 for severely food insecure urban beekeeper households. From this result, we observed that food insecure households have higher family size and this result confirmed by Ifa (2020) found that higher family size households were food insecure.

Age of households head (AHH): Age is one of the variables used in analysis of the characteristics of the small scale urban beekeeper households in the study area related to their household food security status. Table 4.8 presented the findings of the computed mean of the urban beekeeper household food security status. The average mean age of food secured households was 51.66 year while that of severely food insecure households is 44 years. This result shows that the mean age of food secure households is higher than that of severely food insecure urban beekeeper households despite there is no significant mean difference.

Education status of household head (ESHH): Education is an important instrument to improve household's livelihoods through diversifying the urban beekeeper households' income generating ability and better understanding and tendency of involving in urban beekeeping activity. The results indicated that (f=2.26, p=0.0890) there was a positive significant mean difference of education status of urban beekeeper households head between the food secure and food insecure households (Table 4.11). The result indicated that the education status of food secure urban beekeeper households is higher than that of food insecure urban beekeeper households.

Number of Traditional hives (TRADHIVE): The result presented in (Table 4.11) shows that the mean number of traditional hive holding size of food secure urban beekeeper households was 0.33, while for mild food insecure is 0.78, for moderately insecure 2.42, and for severely food insecure 2.26. The test value (f=0.63, p=0.600) shows that there is no significance difference among the groups.

Number of Transitional hives (TRANHIVE): The mean number of transitional hives of food secure households was 0.33 while, for that of mild food insecure households is 0.25, for moderately insecure households 0.263, and the severely food insecure households do not have transitional hives, despite there is no significance difference among the groups.

Number of modern hives (MODHIVE): Table 4.11 presented that the mean of modern bee hives of food secure households was 0.33 while that of mild food insecure households is 0.25, for moderately insecure households 0.289, and the severely food insecure households do not have improved hives, despite there is no significant difference among the groups.

Price of honey (PH): The computed mean sales' price of honey for food secure urban beekeepers was 297.7 0.33 while that of mild food insecure households was 314.28, for moderately insecure households was 291.57, and that of severely food insecure households is 366.6, despite there is no significant difference among the groups. The urban beekeepers who obtain more number of improved hives have higher amount of annual honey production.

Table 4. 11. Description of household food security for those of continuous variables

Variables	Food Secured Household(9)	Mild food insecure (28)	Moderately insecure(38)	Severely insecure(3)	F-Value	P-Value
	Mean Value (SD)	Mean Value(SD)	Mean Value(SD)	Mean Value(SD)		
Family size of household (FSHH)	3.88 (1.9)	5 (1.72)	4.86 (1.39)	5.33 (3.05)	1.18	0.3220
Age of households head (AHH)	51.66 (10.79)	52.60 (13.70)	52.42 (11.25)	44 (2)	0.48	0.6949
Number of Traditional hives (TRADHIVE)	0.33 (0.70)	0.78 (1.39)	0.92 (1.34)	0.33 (0.57)	0.63	0.600
Number of Transitional hives (TRANHIVE)	0.33 (0.70)	0.25 (0.92)	0.263 (0.162)	–	1.07	0.366
Number of modern hives (MODHIVE)	0.33 (0.5)	0.25 (0.44)	0.289 (0.459)	–	0.46	0.711
Price of honey (PH)	297.7 (43.8)	314.28 (66.02)	291.57 (57.58)	366.6 (76.37)	1.93	0.132

Note: * show significance at p< 0.1

Source: Own survey data computed (2021)

4.4.3. Econometric Analysis of the Importance of Urban Apiculture to Food Security

A number of variables were considered in the model, and some are found to be significant in explaining the contribution of apiculture to food security. Among these, use of printed wax foundation (UPWF) and Experience of urban beekeeping and management (EUBM) are significant.

Use of printed wax foundation (UPWF): The. The study results show use of printed wax foundation plays an important role. However, most food secure urban beekeeper households did not use, while only about 33.3% of them use wax foundation as input for their improved hives.. Severely food insecure urban beekeeper households have no tendency of using wax foundation in the apiary of. The result of statistical analysis show significant difference among the groups (X^2 =17.77, p=0.000) at 1% level of significant between food secured and severely food in secured urban beekeeper households.

Experience of urban beekeeping and management (EUBM): The result in Table 4.12 shows that the experience of urban beekeeping of sample households was higher for food secure households than the food insecure households at a statistically significance difference. The chi-square test shows (X^2 = 12.68, p=0.007) at 1% statistical significant level positive effect.

Table 4. 12 Description of urban beekeeping household food security for dummy variable

Variables	Category	Food Secured (9)		Marginally food in secured (28)		Moderately food insecure(38)		Severely food insecure(3)		X^2	P-Value
		Count	Percent	Count	Percent	Count	Percent	Count	Percent		
Sex of households head (SHH)	Female	4	44.4	7	25	13	34.2	0	0	2.7722	0.428
	Male	5	55.5	21	75	25	65.8	3	100		
Use of printed wax foundation (UPWF)	No	3	33.3	23	82.1	35	92.1	3	100	17.77	0.000
	Yes	6	66.7	5	17.9	3	7.9	0	0		
Access of credit service for apiculture (ACSAP)	Yes	0	0	0	0	1	2.6	0	0	1.066	0.785
	No	9	00	28	100	37	97.4	3	100		
Experience of urban beekeeping and management (EUBM)	No	1	11.1	18	64.3	28	73.7	1	33.3	12.68	0.007
	Yes	8	88.9	10	35.7	10	26.3	2	66.7		
Apiary land type (AL type)	No	8	88.9	25	89.3	38	100	3	100	4.674	0.197
	Yes	1	11.1	3	10.7	0	0	0	0		

Note: ***, **, show significance at p<0.01, and p<0.05 respectively

Source: Analysed from own survey 2021

4.4.4. Order Logit Analysis Result for Urban Beekeeper Household Food Security Analysis

A number of variables were considered in the analysis using the ordered logit model. Accordingly, variables, such as family size of households, Education status of household head (ESHH), Use of printed wax foundation (UPWF), Access of credit service for apiculture (ACSAP), Experience of urban beekeeping and management (EUBM), and Apiary land type (AL type) are found to be significantly and positively explaining the food security of households. Some of these variables are explained as follows.

Education status of household head (ESHH): As expected, the status of education level of urban beekeeper households had a positive and significant effect on households' food security

status with Coef. value of (0.4276193) and probability of (p=0.034) at 5% level of significance. This result suggests that literacy for urban beekeeping households likely enhances them to produce more hive products with proper understanding and with better extent improving their household food security than illiterate urban beekeeper households.

Use of printed wax foundation (UPWF): From the dummy variables, urban apiculturist practice of using printed wax foundations to their improved hive types were statistically significant at 1% (p=0.000) with the mean value of (17.7691). This result implies that there is a better understanding and tendency of using printed wax foundation to increase their honey production amount per improved hive.

Access of credit service for apiculture (ACSAP): The result implies access to credit service for urban beekeeping found to be positive and significant effect on urban apiculture at (p=0.048) significant level. Access of credit service for small scale urban apiculture practice has to be the probability of increase by 5%. This result suggests that access of credit service for this sub-sector directly support household food security by increasing the urban apiary production and productivity sustainably.

Experience of urban beekeeping and management (EUBM: Beekeeping experience plays a vital role for apiculture business management. To expand the apiary and produce more the beekeepers experience to manage properly their swarm / honey bee colony is an important factor. As indicated in (Table 4.14), it shows a positive significant at 10% significant level (Coef.= 1.001937 and p= 0. 0.065) for urban beekeepers on practice of urban apiculture. This implies that more experienced beekeeper could produce better amounts of hive product and share their trends (contributes) as well as play their own role on urban beekeeping activities to promote it.

Apiary land type (AL type): The urban beekeepers households who had their own lands more involves in urban beekeeping activity than those households do not have their permanent apiary land. The urban apiary land type (own and rental type) affect the urban apiculture accordingly. Having own apiary land affect urban apiculture positively and significantly (Coef.= 1.913and p=0.072) at 10% level of significant. The possible reason could be, as urban beekeepers use their own land for their apiary, they minimize costs of production (they use rent free) and sustainably continued their practice and improve their household food security. Otherwise they use rental

land for their apiary, in response increase their cost of production and negatively affected their apiary and household food security as well their apiary sustainability is challenged.

Table 4.13. Order logit analysis result for urban beekeeper household food security situation

Variables	Coef.	Std. Err.	Z	P>|z|
Sex of households head (SHH)	0.1304949	0.5372215	0.24	0.808
Family size of household (FSHH)	-0.3274415	0.1697101	-1.93	0.054*
Age of households head (AHH)	.0039608	0.020119	0.20	0.844
Education status of household head (ESHH)	0.4276193	0.2020992	2.12	0.034*
Use of wax foundation (UPWF)	2.491746	0.7958291	3.13	0.002***
Number of Traditional hives (TRADHIVE)	-0.1421453	0.2042574	-0.70	0.486
Number of Transitional hives (TRANHIVE)	0.3153694	0.3844845	0.82	0.412
Number of modern hives (MODHIVE)	0.3642813	0.6228256	0.58	0.559
Access of credit service for apiculture (ACSAP)	4.739534	2.400652	1.97	0.048 *
Experience of urban beekeeping (EUBM)	1.001937	0.542849	1.85	0.065*
Price of honey (PH)	0.0024741	0.0038843	0.64	0.524
Apiary land type (AL type)	1.913748	1.062747	1.80	0.072*
/cut1	2.107669			
/cut2	6.05902			
/cut3	9.004596			

Source: Own survey data computed (2021)

CHAPTER FIVE : CONCLUSION AND RECOMMENDATIONS

5.1 Conclusions

The objective of this study was to analyze urban apiculture production and its contributions to household food security, the case in Kolfe Keranio sub-city, Addis Ababa, Ethiopia. The study used mixed method design that comprised both quantitative and qualitative data analysis. Descriptive and econometrics (multiple leaner and ordered logit) models were used. Multiple linear regression model was used to analyze the factors affecting urban apiculture development. And, ordered logistic regression model was used to analyze its contribution to food insecurity access scale (HFIAS) by classifying urban beekeeper households food insecurity scale based on FAO classification as food secure; mildly food insecure; moderately food insecure and severely food insecure for the purpose of further investigation on study area food security status of urban beekeeper households.

The characteristics of households in relation to urban beekeeping practices and their food security status were analyzed by using t-test and correlation coefficient for dummy and continuous variables. Fifteen independent variables were selected based on empirical reviews conducted by different scholars and the city administration level urban agriculture unpublished documents and reports, which can influence small scale urban apiculture production and urban beekeeper households' food security status. From identified explanatory variables, nine of them were found to be significant in influencing urban apiculture honey production and six were found to be significant in determining household food security status.

The first model was employed to identify the factors that explain urban apiculture practice and honey yields. Variables such as age of household, apiary land size, number of transitional hives, improved hives, frequency of extension contact, price of honey; experience of urban beekeeping, use of printed wax foundation and access of credit service for urban apiculture are statistically significant in explaining the urban apiculture yield. The linear regression result shows that apiary land size, printed wax foundation use, number of transitional hives, number of modern hives, frequency of extension contact, price of honey, access of swarm and experience of urban beekeeping have positively and statistically significant effect to determine the urban beekeepers

honey production and amount of honey obtained from the sub-sector. Likewise; age of urban beekeeper household head is negatively related with the urban apiculture development.

Finally; the household food security status was measured by HFIAS scale. The ordered logit analysis confirmed that majority of the urban beekeeper household respondent 48.7% (38) were moderately food in secure; 35.9% (28) were mildly food insecure; 3.8 (3) were severely food insecure and the only 11.5% (9) were food secure urban beekeepers in the study area.

Moreover; the ordered model was used to identify factors that determine urban beekeepers household food security status. The analysis result confirmed that education status of household head; use of wax foundation; access of credit service; experience of urban beekeeping and apiary land indicate positively and significant influence to determine urban beekeeper household food security. However; family size of urban beekeeper households has confirmed negative relationship with the urban beekeeper household food security status.

Moreover the finding of the research indicate that various constraints reflected by the urban beekeeper households and continuous field observation and survey. The most important identified determinant factors were lack of skill and knowledge; awareness gap and lack of social resources network summarized as constraints of as social capital. Lack of apiary production land; lack of finance access; in access to market etc. were included as economic problems. Lack of policy and strategy; technology and input supply; facilitation of credit service; establishment; of quality control and honey standards; establishment of training and bee research center and so on were included as institutional constraints. In accessibility of apiary tools and equipment; lack of pure water; in appropriately apiary installations were physical capital constraints.

5.2. Recommendations

To improve urban apiculture development and enhance its contribution for food security, the following recommendations were suggested based on the study findings. These recommendations should be assumed to give insight for specific responsible institutions future policy and strategy formulation regarding to urban apiculture development and its contributions to household food security and also it used as an inputs for further investigations in the country city and towns.

- This study finding indicate that use of small scale urban apiculture production with improved hive result show increment for contributions of honey production and household food security. This finding found that introducing improved hive type with appropriate skill training and related hive technology input to small scale urban beekeeper improve their income generating ability and positively contribute to food security. Therefore, both the ministry of agriculture and Addis Ababa urban agriculture commission should formulate applicable policy and workable strategy and package for urban apiculture development.
- Based on the findings, extension service, credit, apiary land space, skill based training, improved hive technology, input supply and swarm input facilitation were the major institutional and economic issues that should be solved and provided to urban beekeeper households. Therefore; the issue of beekeeping professional extension expert allocation, apiary space and input facilitation should be solved by the city administration urban agriculture development commission and its interfaced stakeholders.

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Annexes

Annex 1: Descriptive statistics results

```
. spearman UAP AHH FSHH ALSHH TRADHIVE TRANHIVE MODHIVE FECF HINI BPOH Experience,stats(rho p)star(0.05)
(obs=78)
```

Key
rho *Sig. level*

	UAP	AHH	FSHH	ALSHH	TRADHIVE	TRANHIVE	MODHIVE	FECF	HINI	BPOH	Experi~e
UAP	1.0000										
AHH	0.4865*	1.0000									
	0.0000										
FSHH	0.0247	0.0238	1.0000								
	0.8302	0.8361									
ALSHH	0.7527*	0.3003*	0.1655	1.0000							
	0.0000	0.0076	0.1475								
TRADHIVE	-0.3825*	-0.2951*	0.2605*	-0.1785	1.0000						
	0.0005	0.0087	0.0213	0.1179							
TRANHIVE	0.0463	0.0551	-0.0605	-0.0337	-0.1900	1.0000					
	0.6871	0.6321	0.5987	0.7696	0.0957						
MODHIVE	0.9058*	0.4456*	-0.0320	0.6802*	-0.4128*	-0.1624	1.0000				
	0.0000	0.0000	0.7810	0.0000	0.0002	0.1555					
FECF	0.7959*	0.3203*	-0.0184	0.7068*	-0.1550	0.0155	0.7920*	1.0000			
	0.0000	0.0043	0.8729	0.0000	0.1754	0.8930	0.0000				
HINI	-0.2152	-0.0028	-0.1003	-0.1904	-0.2041	0.0608	-0.2317*	-0.3648*	1.0000		
	0.0585	0.9804	0.3824	0.0949	0.0731	0.5968	0.0412	0.0010			
BPOH	-0.1359	-0.0099	0.0122	-0.1852	-0.1521	0.0498	-0.1275	-0.2556*	0.0315	1.0000	
	0.2355	0.9316	0.9153	0.1045	0.1838	0.6653	0.2661	0.0239	0.7843		
Experience	0.5010*	0.2274*	-0.1538	0.3474*	-0.0676	0.1316	0.4337*	0.4676*	-0.0141	-0.2981*	1.0000
	0.0000	0.0453	0.1787	0.0018	0.5566	0.2507	0.0001	0.0000	0.9022	0.0080	

.

```
> ———————————————————————————————————————————————————————————————————————————————————————————————————————————————
>                (1)
>
>
>                UAP          AHH         FSHH        ALSHH     TRADHIVE     TRANHIVE      MODHIVE         FECF         HINI
>    BPOH    Experie~e
> ———————————————————————————————————————————————————————————————————————————————————————————————————————————————
UAP                 1
>
AHH             0.232*           1
>
FSHH           0.0486    -0.000424            1
>
ALSHH           0.652***     0.292**     0.0906            1
>
TRADHIVE     -0.0973       -0.169        0.263*      -0.142            1
>
TRANHIVE      0.0630       0.0485       0.0218      -0.0565       -0.141            1
>
MODHIVE         0.932***     0.310**    0.00426        0.627***    -0.139      -0.0756           1
>
FECF            0.853***     0.157      0.00195        0.624***   -0.0295       0.0750        0.832***         1
>
HINI           -0.340**   -0.00329      -0.0970       -0.219       -0.163       0.0609       -0.306**     -0.381***         1
>
BPOH          -0.0554       0.0686       0.0871      -0.0969       -0.147      -0.0644      -0.0786       -0.123       0.0153
>       1
Experience      0.646***     0.141      -0.0684        0.352**     0.0866       0.0928        0.586***     0.497***   -0.0431
>  -0.233*           1
———————————————————————————————————————————————————————————————————————————————————————————————————————————————
> ———————————————————————————————————————————————————————————————————————————————————————————————————————————————
* p<0.05, ** p<0.01, *** p<0.001
```

Annex 2 : Multi linear models result

```
. regress UAP SHH AHH FSHH ALSHH UPWF TRADHIVE TRANHIVE MODHIVE ACSAP FECF HINI POPW BPOH AS Experience
```

Source	SS	df	MS	Number of obs	=	78
				F(15, 62)	=	60.33
Model	637891.439	15	42526.0959	Prob > F	=	0.0000
Residual	43700.5095	62	704.846927	R-squared	=	0.9359
				Adj R-squared	=	0.9204
Total	681591.949	77	8851.84349	Root MSE	=	26.549

UAP	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
SHH	6.057984	6.897539	0.88	0.383	-7.73	19.84597
AHH	-.4667867	.268824	-1.74	0.087	-1.004158	.0705848
FSHH	.0788999	2.158255	0.04	0.971	-4.23539	4.39319
ALSHH	.1481746	.070906	2.09	0.041	.0064356	.2899136
UPWF	16.80898	7.880731	2.13	0.037	1.055623	32.56234
TRADHIVE	-3.1544	3.025437	-1.04	0.301	-9.202163	2.893363
TRANHIVE	13.02352	5.916418	2.20	0.031	1.196772	24.85027
MODHIVE	21.46177	2.430347	8.83	0.000	16.60358	26.31996
ACSAP	14.93933	28.08808	0.53	0.597	-41.20794	71.08661
FECF	14.62168	6.978931	2.10	0.040	.6710002	28.57237
HINI	-3.323255	2.988599	-1.11	0.270	-9.29738	2.65087
POPW	-3.798914	22.25893	-0.17	0.865	-48.29387	40.69605
BPOH	.0826992	.0492545	1.68	0.098	-.0157592	.1811576
AS	13.6523	7.175356	1.90	0.062	-.6910279	27.99564
Experience	3.771274	1.098792	3.43	0.001	1.57482	5.967728
_cons	-45.85588	39.6782	-1.16	0.252	-125.1715	33.45972

```
. vif
```

Variable	VIF	1/VIF
MODHIVE	5.91	0.169075
FECF	4.75	0.210712
Experience	1.95	0.512105
ALSHH	1.94	0.514278
TRADHIVE	1.65	0.604933
UPWF	1.58	0.632308
HINI	1.53	0.653922
TRANHIVE	1.46	0.683771
POPW	1.37	0.730024
AS	1.36	0.732897
FSHH	1.35	0.741194
AHH	1.34	0.749019
BPOH	1.15	0.871529
SHH	1.12	0.891653
ACSAP	1.10	0.905012
Mean VIF	1.97	

```
. linktest
```

Source	SS	df	MS	Number of obs	=	78
				F(2, 75)	=	563.88
Model	639090.462	2	319545.231	Prob > F	=	0.0000
Residual	42501.4868	75	566.686491	R-squared	=	0.9376
				Adj R-squared	=	0.9360
Total	681591.949	77	8851.84349	Root MSE	=	23.805

UAP	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
_hat	.8855435	.084142	10.52	0.000	.717924	1.053163
_hatsq	.0003362	.0002312	1.45	0.150	-.0001242	.0007967
_cons	4.900438	5.101933	0.96	0.340	-5.263134	15.06401

Annex 3

HFIAS	Marginal effect(dy/dx)for food secure	Marginal effect(dy/dx) for mildly food	Marginal effect(dy/dx) for moderately food	Marginal effect(dy/dx) for severely food

		insecure	in secure	insecure
SHH	0.0091	0.0137	0.0179	0.0049
FSHH	-0.0228	-0.0345	-0.0450	0.0123
AHH	0.0002	0.0004	-0.0005	-0.0001
ESHH	0.0298	0.0450	-0.0587	-0.0160
UPWF	0.1738	0.2625	-0.3425	-0.0937
TRADHIVE	-0.0099	-0.0149	0.0195	0.0053
TRANHIVE	0.0219	0.0332	-0.0433	-0.0118
MODHIVE	0.0254	0.0383	-0.0500	-0.0137
ACSAP	0.3306	0.4994	-0.6516	-0.1783
EUBM	0.0698	0.1055	-0.1377	0.0377
PH	0.0001	0.0002	-0.0003	-0.0001
AL type	0.1334	0.2016	-0.2631	-0.0720

Source: Own survey data computed (2021)

Annex 4: Survey Questionnaires

Survey Study Part I

QUESTIONNAIRES FOR: ANALYSIS OF URBAN APICULTURE PRODUCTION AND ITS CONTRIBUTIONS TO HOUSEHOLD FOOD SECURITY: THE CASE OF KOLFE KERANYO SUB-CITY, ADDIS ABABA, ETHIOPIA

Dear interviewees

First of all, I would like to say thank you in advance for your concern and kindness that you are willing to replay my interviews for the purpose of conducting my study which is authorized by Addis Ababa University. And I would like to emphasis that your response are extremely valuable for the successful completion of this study and I would greatly appreciate your genuine response for all questions listed below. Lastly, I would assure you that the information you provide will be confidential and used only for academic purpose authorized by the university.

Thank you in advance for your cooperation!

1. City_____ Sub-city_____ Woreda_____

I. Household characteristics

2. Respondent Name (can be head or HH members)_____.
3. Please fill the answer by putting "√" mark in the appropriate space for close ended questions and write your opinion on the space provided for open ended questions.
4. Please return the completed questionnaire as much as possible.
5. Gender Male_____Female_____
6. Family Member Male_____ Female_____Total_____
7. Age (18-25)____ (26-35)____ (36-45)____ (46-55)____ (56-65)_____ (Above 65)_____
8. Educational level:
   9.1 Illiterate_____9.2. Primary Education _____9.3. Secondary Education_____
   9.4.Diploma ____9.5. First degree____9.6.Masters and Above_____
10. Respondent's position
    10.1. Apiculture Owner_____ 10.2. Employee of the Owner_____
11. Firm ownership Status

11.1. Private /household level____11.2. Partnership enterprise_____
11.3. Cooperative____11.4. Other types_____Please specify? It is_____

12. Types of Apiculture hives used , Production capacity and starting year

No.	Starting year	Traditional			Transitional			Modern		Modern
		No.	Product (k/g/hive/season)		No.	Product (k/g/hive/ season)		No.	Honey Product (k/g/hive/ season)	Honey Products (k/g/hive/year
1			Honey	wax		honey	Wax			

13. Apiculture land position
    13.1. Governmental_____13.2. Private_____13.3.Rental_____13.4. Back yard_____
    13.5. On the building roof_____13.6. On the fence wall_____13.7 If any other _____.
14. How did you start beekeeping?
    14.1 By training_____ 14.2. Learning from family_____14.3. As a Hobbies_____
    14.4. If other please specify_____ _____.
    15. Fill the following table accordingly please?

No.	Sources	Quantity	Traditional	Transitional	Modern
1.	From Parents				
2.	Catching swarms				
3.	Buying swarms				
4.	Others (specify)				

16. If the answer for question 15 in the table is purchased, where is the market? 16.1. In your locality____16.2. Country side surrounding woredas market_____16.3. At neighbor woredas farmers_____16.4. If other sources please specify? _____ _____.
17. What is the price of one colony?____ETB. Please fill below in the table accordingly

No.	Colony with hives	Price Et. Birr			Remark
		Minimum	Mean	Maximum	
1.	Traditional hives				
2.	Traditional hives with colonies				
3.	Transitional hives				
4	Transitional hives with colonies				
5.	Modern hives				
6.	Modern hives with colonies				
7	Only colonies				

18. What are the characteristic features of your honeybees?
    18.1. Behaviours: (A) Docile_____ (B) Aggressive_____ (C) Very aggressive_____
    18.2. Colour: (A) Black_____ (B) Red_____(C) Grey_____ (D) Mixture_____
    18.3. Size: (A) Big_____(B) Medium_____(C) Small_____
    18.4. Which one is more productive? Behaviours:_____, Colour:_____, Size:_____
19. What are the source and cost of bee hives with itsaccessories? Please fill in the table below?

No.	Materials	Home made	Locally made and purchased	By lending from Agriculture office	Provided on credit purchased	Donated by Gov. or NGO's	Price (ETB)		Service period (years)
							Rent	Purchase	
1	Modern hives								
2	Transitional hives								
3	Traditional hives								
4	Veils								
5	Gloves								
6	Smoker								
7	Boots								
8	Water sprayer								
9	Bee brush								
10	Queen catcher								

11	Queen excluder								
12	Chisel								
13	Knife								
14	Frame wire								
15	Honey presser								
16	Bee wax pure								
17	Casting mold								
18	Uncapping fork								
19	Honey extractor								
20	Honey container								

20. Have you got enough credit for your business?
    20.1Yes_____20.2 Less credit_____20.3 No credit at all_____
21. Does the firm have honey processing facility? (21.1) Yes____ (21.2) No _____
22. Do you participating in beekeeping extension packages? (22.1) Yes____ (22.2) No____
23. Did you receive training/ advice of improved beekeeping management practice from DAs? (23.1) Yes_____ (23.2) No_____
24. If yes where you obtained? (24.1) Development agent____ (24.2) community leader____ (24.3) Market participant beekeeper____ (24.4) Neighbors___ (24.5) Relatives and friends____ (24.6) Radio, television, newsletter____ (24.7) Others_____.
25. If you applying the training/advices, did you achieve any improvements in your colony? (25.1) Yes____ (25.2) No____If not, why? (25.3) not affordable___ (25.4) not simple to apply/not understood____ (25.5) Not relevant to my colonies´ problem____(25.6) labour shortage____ (25.7) others, specify_____
    _____.
26. How does the firm rate the extension service provided to beekeepers by government?
    26.1. Excellent____ 26.2. Very good____26.3.Good_____26.4. Poor_____
27. If there is an increase in trend in number of bee colonies over the years, what is the cause? 27.1 availability of bee forage_____27.2. Management_____ 27.3. Improved hive_____ 27.4 If other specify?_____
    _____.
28. If there is an increase in trend in honey yield over the years? Yes____ No.____ If yes what is the cause?
    28.1Good market price_____28.2. Use new technologies_____28.3.Added more bee colonies_____28.4. Others (specify)_____
    _____.
29. Does beekeeping profitable to the area? (29.1) Yes_____(29.2)No,_____ Reason_____.
30. What about urban apiculture production potentials and honey forage availability?
    30.1. Excellent____ 30.2. Very good____30.3.Good_____30.4. Poor_____

31. If there is a decrease in trend in the number of bee colonies and honey yields over the year, what is the cause in order of importance?

No.	Causes	Rank	Season of Occurrences	Measures taken
1	Lack of bee forage			
2	Lack of water			
3	Absconding			
4	Pests and predators			
5	Diseases			
6	Pesticides and herbicides application			
7	Death of colony			
8	Decrease in price of honey			
9	Increased cost of production			
10	Luck of credit service			
11	Others (specify)			

32. Did you plant bee forage species purposely for your bees?
    32.1Yes____32.2.No.____32.3. If yes list them_____
    _____.
33. Did you feed your honeybee colonies? 33.1. Yes_____ 33.2. No_____33.3. If yes, when do you feed your honeybees? (Months)_____.
34. If you feed what kind of supplement feeds do you offer to your honeybees?
    34.1 Besso_____ kg/colony/season 34.2Shiro_____ kg/colony/season
    34.3 Sugar syrup_____kg/colony/season 34.4 Honey + Water_____ kg/colony/season
    34.5 Others (specify)_____ kg/colony/season
35. Does water available for your honeybees at all the time?
    35.1Yes_____ 35.2. No_____ 35.3. If yes what is the source?_____
    _____.
36. Do you clean your apiary? (36.1) Yes____ (36.2) No,____ If no why? _____
    _____.
37. Do you inspect your beehives and colonies by yourself? (37.1) Yes_____ (37.2) No_____
38. If you do how frequently do you inspect your hive? (38.1) Every day___ (38.2) Every two to three days_____ (38.3) Every week_____ (31.4) Other (specify)_____
    _____.
39. If no inspection, what is the reason? _____.
40. Does swarming occur in your colonies or locality? (40.1) Yes____ (40.2) No____
41. If your response is yes, what is the frequency? (41.1) Every season___ (41.2) Every year___ (41.3) Once in two years____ (41.4) Others, specify: _____
    _____.
42. When does swarming occur more frequently? (Months) From_____ to _____.
43. Is swarming advantageous to your food security? (43.1) Yes___ (43. 2) No___
44. If yes, describe the reason(s) (44.1)To increase my number of colony____ (44.2 To sale and get income____ (44.3)To replace non-productive bee colonies_____ (44.4)_____ (44.5)Others relative to household food security specify:_____
    _____.
45. Do you control / prevent/ swarming? (45.1) Yes____ (45.2) No_____(45.3) If yes, what methods do you use to control / prevent/ swarming?_____
    _____.
46. Do you have swarms catching experience? (46.1) Yes_____ (46.2) No_____
47. For what purpose do you use your honey? (47.1) Consumption_____ (47.2) Selling____ (47.3) Both_____
48. What is the annual income from sale of hive product and bee colonies?

No.	Type of product	Quantity	Unit price /kg (swarm)	Total income
1	Honey			
2	Bees wax			
3	Colonies			

49. How do you set the price of hive products? (A) The buyer_____ (B) Myself_____ (C) Negotiation_____
50. Who are your customers? Encircle the one from the following.
    A. 'Tej' houses____
    B. Middlemen____
    C. Retailers____
    D. Wholesalers____
    E. Individual consumers_____
    F. Others/specify/_____
51. Is there any market problem in your locality? 51.1 Yes____ 51.2 No_____
52. What are the major reasons for the domestic honey marketing problem?
    52.1 Poor market information's____ 52.2. Lack of organized market____52.3. Lack of legality____52.4. Adulteration_____52.5. Smuggling_____52.6.If Others (specify)_____.
53. In your opinion, what measures should the government take to improve the sub-city apiculture development?_____
54. According to your opinion what kinds of interventions are required to improve the productivity of beekeeping in your area?_____
    _____
    _____.

55. Table. Household Food Insecurity Access Scale (HFIAS) Measurement standard Tool

No.	Question	Response Options	CODE
1.	In the past four weeks, did you worry that your household would not have enough food?	0= No (skip to Q2) 1=Yes	….|___|
1.a	How often did this happen?	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)	….|___|
2.	In the past four weeks, were you or any household member not able to eat the kinds of foods you preferred because of a lack of resources?	0 = No (skip to Q3) 1=Yes	….|___|
2.a	How often did this happen?	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)	….|___|
3.	In the past four weeks, did you or any household member have to eat a limited variety of foods due to a lack of resources?	0 = No (skip to Q4) 1 = Yes	….|___|
3.a	How often did this happen?	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)	….|___|
4.	In the past four weeks, did you or any household member have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food?	0 = No (skip to Q5) 1 = Yes	….|___|
4.a	How often did this happen?	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)	….|___|
5.	In the past four weeks, did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?	0 = No (skip to Q6) 1 = Yes	….|___|
5.a	How often did this happen?	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)	
6.	In the past four weeks, did you or any other household member have to eat fewer meals in a day because there was not enough food?	0= No (skip to Q7) 1 = Yes	….|___|
6.a	How often did this happen?	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)	….|___|
7.	In the past four weeks, was there ever no food to eat of any kind in your household because of lack of resources to get food?	0 = No (skip to Q8) 1 = Yes	….|___|
7.a	How often did this happen?	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)	
8.	In the past four weeks, did you or any household member go to sleep at night hungry because there was not enough food?	0 = No (skip to Q9) 1 = Yes	….|___|
8.a	How often did this happen?	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)	….|___|

9.	In the past four weeks, did you or any household member go a whole day and night without eating anything because there was not enough food?	0 = No (questionnaire is finished) 1 = Yes	….|___|
9.a	How often did this happen?	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)	….|___|

56. Information on hive product production and currently estimated value

	Amount of produced (In Kg per year)	Consumption (In Kg per year)	Sold (In Kg)	Current price (In birr)	Total income
Honey					
Wax					
Colonies (swarm)	No				

Thank you for your cooperation! Compiler:
Name_____Signature_____Date_____

Thank you for your cooperation!

Survey Study Part II

QUESTIONNAIRES FOR: ANALYSIS OF URBAN APICULTURE PRODUCTION AND ITS CONTRIBUTIONS TO HOUSEHOLD FOOD SECURITY: THE CASE OF KOLFE KERANYO SUB-CITY, ADDIS ABABA, ETHIOPIA

Dear interviewees

First of all, I would like to say thank you in advance for your concern and kindness that you are willing to replay my interviews for the purpose of conducting my study which is authorized by Addis Ababa University. And I would like to emphasis that your response are extremely valuable for the successful completion of this study and I would greatly appreciate your genuine response for all questions listed below. Lastly, I would assure you that the information you provide will be confidential and used only for academic purpose authorized by the university.

Thank you in advance for your cooperation!

1. City_____ Sub-city_____ Woreda_____
2. Cooperatives Name _____.
3. Please fill the answer by putting ″√" mark in the appropriate space for close ended questions and write your opinion on the space provided for open ended questions.
4. Please return the completed questionnaire as much as possible.

Interview guideline for beekeepers cooperatives

1. When was the cooperatives established? _____
2. What are the criteria for membership?
3. What was the objective to establish the cooperative? _____
4. What is the firms ultimate goal?_____
5. How many members does the cooperative have at the moment? Male___ Female___ Total___
6. What kinds of services (provision of inputs, training, assistance in product marketing, etc) does the cooperative get to its members? 6.1Yes_____6.2 No____ 6.3 If yes from who list each ofplease?_____
7. Is the cooperative is also involved in honey and beeswax marketing? 7.1 Yes____7.2 No____, 8. Is there any kind of contract agreements with the honey producers? 8.1 Yes____ 8.2 No_____8.3 How is the price set?_____.
9. Is there an problems does facing the cooperatives? 9.1 Yes____ 9.2 No_____ 9.3 If yes please _____
10. What type of problem does face from the input supply side?_____
From the customer side?_____

11. How many kilogram of honey does the cooperative produce per year from its firm? _____?Who are the main customers of buyer?_____.
12. What are the main problems faced for the cooperative in performing its task? _____
_____
_____.
13. Is there support of the governmental organizations for the cooperative input, market linkage, training and extension service/ follow up? 13.1 Yes_____ 13.2 No_____
14. Is therea support of the non-governmental organizations for the beekeeping cooperative? 14.1 Yes_____ 14.2 No_____
15. Can you mention the major constraints in the honey and beeswax value chain? (Production, processing, marketing, coordination, etc)?_____
_____
_____.
16. What do you suggest to improve the situation?_____
_____
_____.
17. What opportunities do exist in your locality for the beekeeping sector?_____
_____
_____.

Thank you very much for your Genuine Information!

Check list for Focusing Group Discussion (FGD)

1. Did you know about food security concept? Yes---- No-----
2. What are the main constraints or challenges faced in the sub-city during apiculture development?_____
   _____
   _____.
3. How is the food security Status of the household in the study area?_____
   _____
   _____
   _____.
4. Which types of bee hives prefer to use for beekeeping in the area?_____
   _____
   _____
   _____.
5. Did you get on food security and beekeeping related training?
6. What is your perception on the urban apiculture business and development?
   _____
   _____
   _____
7. How do you express the nature of urban apiculture?
   _____
   _____
   _____
8. Which types of bee hives are more profitable (Traditional, Transitional, Modern) ?
   _____
   _____
   _____
9. What kind of problem faced in time of involving in urban apiculture practice?_____

Survey Study Part III

QUESTIONNAIRES FOR: ANALYSIS OF URBAN APICULTURE AND ITS CONTRIBUTIONS TO HOUSEHOLD FOOD SECURITY: THE CASE OF KOLFE KERANYO SUB-CITY, ADDIS ABABA, ETHIOPIA

Dear interviewees

First of all, I would like to say thank you in advance for your concern and kindness that you are willing to replay my interviews for the purpose of conducting my study which is authorized by Addis Ababa University. And I would like to emphasis that your response are extremely valuable for the successful completion of this study and I would greatly appreciate your genuine response for all questions listed below. Lastly, I would assure you that the information you provide will be confidential and used only for academic purpose authorized by the university.

Thank you in advance for your cooperation!

1. City_____ Sub-city_____Woreda_____
2. Institutions Name _____.
3. Please fill the answer by putting "√" mark in the appropriate space for close ended questions and write your opinion on the space provided for open ended questions.
4. Please return the completed questionnaire as much as possible.

Questions for the woredas administration farmers and urban agriculture development office

1. Total number of urban agriculture households in the Woreda? Male___ Female____Total____
2. What is the total number of beekeeper in the Woreda? Male_____ Female_____ Total_____
3. What is the total number of bee hives in the Woreda in 2012/2020, 3.1Traditional hives____ 3.2 Transitional hives_____ 3.3 Modern hives_____ 3.4 Cooperatives_____
4. What is the average productivity of the different hives in the Woreda?
   Modern hive_____(kg/ harvest),Traditional hive_____(kg/harvest) Transitional hives_____(kg/harvest)
5. What types of beekeeping widely practiced in the Woreda? Modern____ Transitional_____Traditional_____
6. Do you have apiculture professionals alone in the in the Woreda level? 6.1 Yes_____ 6.2 No_____
7. What is the trend in the number of honey bee colonies in the Woreda7.1 Yes increasing____ or 7.2 No_____decreasing)? Explain the reason for both trends? _____
8. What is the general perspective of the beekeeping activities in the Woreda related to food security? _____
9. What are the main problems in honey production and marketing in the Woreda (9.1Lack of awareness_____,9.2 Traditional production system_____, 9.3 Inaccessibility of credit service_____)? Please explain more what you know?_____
10. What is the potential of the area for beekeeping? 10.1 High_____10.2 Medium_____1.3 Low_____
11. What is the major challenging constraints for beekeeping business in the Woreda?_____
12. What opportunities do exist in the Woreda to involve in the beekeeping activities?_____
13. What is the contribution share of beekeeping to income generation for household's food security in the Woreda? _____
14. What can be done to increase the efficiency of urban apiculture products / its possible contributions to household food security in your Woreda? Who should do it?_____

Thank you for your cooperation!

Survey Study Part IV

QUESTIONNAIRES FOR: ANALYSIS OF URBAN APICULTURE AND ITS CONTRIBUTIONS TO HOUSEHOLD FOOD SECURITY: THE CASE OF KOLFE KERANYO SUB-CITY, ADDIS ABABA, ETHIOPIA

Dear interviewees

First of all, I would like to say thank you in advance for your concern and kindness that you are willing to replay my interviews for the purpose of conducting my study which is authorized by Addis Ababa University. And I would like to emphasis that your response are extremely valuable for the successful completion of this study and I would greatly appreciate your genuine response for all questions listed below. Lastly, I would assure you that the information you provide will be confidential and used only for academic purpose authorized by the university.

Thank you in advance for your cooperation!

1. City_____ Sub-city_____
2. Institutions Name _____.
3. Please fill the answer by putting "√" mark in the appropriate space for close ended questions and write your opinion on the space provided for open ended questions.
4. Please return the completed questionnaire as much as possible.

Questions for the sub-city administration farmers and urban agriculture development office

1. Total number of urban agriculture households in the sub-city: Male___ Female____Total____
2. What is the total number of beekeeper in the sub-city? Male_____ Female_____ Total_____
3. What is the total number of bee hives in the sub-city in 2012/2020, 3.1Traditional hives____ 3.2 Transitional hives_____ 3.3 Modern hives_____ 3.4 Cooperatives_____
4. What is the average productivity of the different hives in the sub-city?
   Modern hive_____(kg/ harvest),Traditional hive_____(kg/harvest) Transitional hives_____(kg/harvest)
5. What types of beekeeping widely practiced in the sub-city? Modern____ Transitional_____ Traditional_____
6. Do you have apiculture professionals alone in the sub-city? 6.1 Yes_____ 6.2 No_____
7. What is the trend in the number of honey bee colonies in the sub-city7.1 Yes increasing____ or 7.2 No_____ decreasing)? Explain the reason for both trends? _____
8. What is the general perspective of the beekeeping activities in the sub-city related to food security? _____
9. What are the main problems in honey production and marketing in the sub-city (9.1Lack of awareness_____,9.2 Traditional production system_____, 9.3 Inaccessibility of credit service_____)? Please explain more what you know? _____
10. What is the potential of the area for beekeeping? 10.1 High_____10.2 Mediuym_____1.3 Low_____
11. What is the major challenging constraints for beekeeping business in the sub-city ?_____
12. What opportunities do exist in the sub-city to involving in the beekeeping activities?_____
13. What is the contribution share of beekeeping to income generation for household's food security in the sub-city? _____
14. What can be done to increase the efficiency of urban apiculture products / its possible contributions to household food security in your sub-city? Who should do it?_____

Thank you for your cooperation!

Survey Study Part VI

QUESTIONNAIRES FOR: ANALYSIS OF URBAN APICULTURE AND ITS CONTRIBUTIONS TO HOUSEHOLD FOOD SECURITY: THE CASE OF KOLFE KERANYO SUB-CITY, ADDIS ABABA, ETHIOPIA

Dear interviewees

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Thank you in advance for your cooperation!

1. Country_____City_____
2. Institutions Name_____.
3. Please fill the answer by putting "√" mark in the appropriate space for close ended questions and write your opinion on the space provided for open ended questions.
4. Please return the completed questionnaire as much as possible.

Question for the city administration farmers and urban agriculture development commission

1. How many registered beekeepers are in the city? Mention them 1.1Male_____
1.2 Female_____1.3Cooperatives_____1.4 If other please_____
2. Is there registered traders and honey collectors involved in honey collection and marketing? 2.1 Yes_____ 2.2 No_____2.3 If yes please list_____
3. Is there any private business or association involved in modern beekeeping in the city?
   3.1. Yes_____ 3.2. No_____
4. Is there association/union which supplies beekeeping equipment for the beekeepers?

4.1.Yes____ 4.2 No____ If yes please list them?
4.3_____
4.4_____
4.5_____
4.6_____
4.7_____

5. Is there any plan to integrate urban river side/garden conservation and area rehabilitation with beekeeping development? 5.1 Yes_____5.2 No_____ Why?_____

6.As a government level,is there identified problems and constraints in the beekeeping development and marketing in the city? 10.1 Yes_____10.2 No_____If yes please list the_____

7. What can be done to increase beekeepers/ honey production in the city with concern of household food security achievement? Who should do it? _____

8. What opportunities do exist in the city for beekeeping activity?_____
_____

9. What are the major identified roles of urban apiculture business in the city? _____
_____

10. The city administrations have policy and strategy for urban beekeeping alone? 10.1 Yes_____10.2 No_____

Thank you for your cooperation!

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