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Assessment of Income from Traditional and Modern Beekeeping Techniques in the Angacha Woreda, the Kembata Tembaro Zone, Ethiopia

Master Thesis

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Declaration

I hereby declare that this thesis entitled Assessment of Income from Traditional and Modern Beekeeping Techniques in the Angacha Woreda, the Kembata Tembaro Zone, Ethiopia is my own work and all the sources have been quoted and acknowledged by means of complete references.

Prague, 18 April 2014

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Bc. Marie Wichsová

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Abstract

Beekeeping provides an important opportunity for increasing off-farm incomes for small-scale farmers in South-Ethiopian highlands. Ethiopia is viewed as the biggest exporter of natural honey in Africa. Due to the minimal amount of farm land available, beekeeping allows farmers to increase their income without losing farmable land because of the small footprint of beehives. This study focuses on the economic contribution of traditional and modern ways of beekeeping to rural households in the Angacha Woreda. Three representative sub-areas were selected. Small-scale beekeepers were questioned using a semi-structured questionnaire. Complementary information was obtained from personal interviews with beekeeping experts on three administrative levels and from the author's own observations. Out of a total of 92 respondents surveyed, 53 % practice traditional beekeeping techniques, 16 % use modern beehives and 31 % own both. Of a total of 339 beehives observed, 81.4 % were traditional and 18.6 % modern. Seasonal honey production is significantly higher for modern beehives compared to the traditional type. The mean price of honey was 8.5 % higher in the case of production from modern beehives. Hence, modern beekeeping seems to be an appropriate option to increase household incomes. Unexpectedly, our results reveal that there is no significant difference between the annual income from traditional and modern beekeeping. The potential reasons are further discussed. In the study area farmers have to contend with several other limitations on beekeeping such as animal pests, adverse natural conditions and the effects of pesticides. Currently both beekeeping techniques have their limitations; however, there is great potential in the dissemination of modern beekeeping if training in modern beehive management is provided.

Key words: honey production; small-scale farmers; modern beehive; traditional beehive; apiculture

Abstrakt

V etiopských vrchovinách nabízí včelařství významnou možnost zvýšení příjmů mimo farmu místních drobných farmářů. Etiopie je považována za největšího vývozce přírodního medu v Africe. Díky velmi malému půdorysu včelích úlů může včelařství pomoci zvýšení příjmů místních farmářů bez ztráty obdělávatelné půdy, která je pro farmáře v Etiopii velmi vzácná. Tato studie se zaměřuje na ekonomický přínos tradičního a moderního včelařství pro místní zemědělce v oblasti Angacha Woreda. Byly vybrány tři zástupné dílčí oblasti. Drobní včelaři byli dotazováni pomocí částečně strukturovaných dotazníků. Doplňující informace byly získány z osobních rozhovorů s odbornými včelaři na třech správních úrovních a také z osobního pozorování autora. Z 92 dotázaných včelařů jich 53 % praktikuje tradiční formu včelařství, 16 % používá moderní úly a 31 % vlastní oba. Z celkem 339 zpozorovaných včelích úlů jich 81.4 % bylo tradičních a 18.6 % moderních. Produkce medu za jednu sezónu je významně vyšší u moderních úlů v porovnání s tradičními. Průměrná cena medu je vyšší o 8.5 % z moderního úlu, a tak se moderní včelaření zdá být vhodnější způsob přivýdělku pro místní farmáře. Přesto, výsledky této práce ukazují, že mezi ročním příjmem z moderního a z tradičního úlu není významný rozdíl. Potenciální důvody jsou diskutovány později. V oblasti výzkumu včelaření mimo jiné omezují i jiné faktory, jako různí škůdci, měnící se přírodní podmínky a účinky pesticidů. I když oba způsoby včelaření mají svoje limity, moderní včelařství vykazuje velký potenciál pro danou oblast v případě, když bude rozvoj moderních včelařů doplněn o vhodná potřebná školení.

Klíčová slova: produkce medu, drobní farmáři, moderní úly, tradiční úly, včelařství

Content

List of Abbreviations

BOAM	Business Organizations and their Access to Markets
EHBPEA	Ethiopian Honey and Bee wax Producers and Exporters Association
HDI	Human Development Index
IFAD	International Fund for Agriculture Development
GDP	Gross Domestic Product
WB	World Bank
CSA	Central Statistical Agency
FAO	Food and Agricultural Organization
DDT	dichlorodiphenyltrichloroethane
SNNPR	Southern Nations, Nationalities, and People's Region
SNV	Netherlands Development Organization
BoARD	Bureau of Agriculture and Rural Development
NOARD	Norway's Development Agency
MT	Metric Ton
MoARD	Ministry of Agriculture and Rural Development
WADO	Woreda Agriculture Development Office
NGO	Non-Governmental Organization
SPSS	Statistical Package for Social Sciences
USAID	U.S. Agency for International Development
PAN UK	Pesticide Action Network United Kingdom
POP	Persistent Organic Pollutant

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1. Introduction

Federal Democratic Republic of Ethiopia lies in horn of Africa. The country does not have any access to the sea coast since 1992 when became landlocked because of the new state Eritrea (Hodder *et al*., 2013). Humanitarian and development cooperation with Ethiopia started in the times of greatest humanitarian disaster of 20th century, famine which engulfed Ethiopia between years 1983 and 1985. It caused more than 600,000 deaths of people before the world even noticed (Gill, 2010). Since 2007 there was significant economic growth in Ethiopia but it still remains one of the poorest countries in the world with 29.6 % of population living below national poverty line 1.25 USD per day (World Bank, 2011). Although Ethiopia is considered as 12th fastest growing economies, country ranks on 174th position out of 187 countries with its HDI (Human Development Index) with GDP 453 USD per capita (World Bank, 2012). Around 25 % of arable land in Ethiopia is cultivated which presents great potential in agriculture. Majority of farmers are smallholders with only rain fed cultivation (IFAD, 2010). Only 0.5 % of total agriculture land is irrigated (World Bank, 2013). Therefore people are very vulnerable to changes in climate conditions such as droughts and floods. Because of the irregularity of harvest of agricultural crops there is needed to create an additional source of independent income for vulnerable families. Rural development policies often decrease the importance of the role of rural non-farm activities and their link with agriculture (Lanjouw and Lanjouw, 1997). Extreme potential in Ethiopia regarding to non-farm income lies in beekeeping. Knowledge about traditional beekeeping management is widely spread within the farmers. The weather and natural conditions in Ethiopia with high variation of honey bee flowering forage contribute to the potential of beekeeping (IPMS, 2005). Climate in Ethiopia is divided into four seasons annually. *Kiremt* or *Meher* (summer) lasts from June to August and is typical for its heavy rain falls in this time period. *Tseday* (spring) continuous with harvest and has duration since September to November. *Bega* is Ethiopian winter lasting from December, till February and there can be frost in morning. *Belg* (autumn) runs from March to May and little raining can occur

and in the end; May is the hottest month in Ethiopia (Munro-Hay, 2002). Because the number of young people with no access to land in Ethiopia is rapidly increasing beekeeping can partially solve the problem (Newsome, 2014). Keeping bees can be an attractive business for the landless and the poor because it needs a relatively small investment and does not have high land requirement. Beekeeping also does not compete severely for resources with other farm enterprises (Gentry 1982; Adjare 1990; MAAREC 2004; Bradbear *et al*., 2011; Woldewahid, 2012). Nowadays many interventions were done to increase the yield of honey of Ethiopian farmers by introduction of improved hives. This study aims to present the comparison of traditional and modern beehives in terms of farmer's income. Also presents assessment of the recent situation and seeks for major factors influencing beekeeping management in Ethiopia.

Literature review

Agriculture is an essential sector of the Ethiopian economy covering 46 % of GDP and involving 83 % of the working population (World Bank, 2012). Considering these facts and the lack of land per capita, it is a necessity to search for other possible ways to improve farmers' livelihoods. According to the study by Gebreselassie from 2006 average farming land of 40.6 % farming smallholders is less than 0.5 hectares. Such a small size of land is not allowing farmer to support him and his family sufficiently (Gebreselassie, 2006). Off-farm (or non-farm) income is one of the widely discussed ways to reduce poverty in developing countries (Canagarajah *et al*., 2001). The strong importance of off-farm activities is described in study of McNamara and Weis from 2001. Non-farm income activities such as honey production are viewed as a very fast growing sector with promising potential to contribute significantly to both households' and the national economy (Diiro, 2013). Beekeeping even it does not enforce much, it is necessary for general well-being in ecosystem. Small scale beekeepers can be found across the world and production of honey and selling of other bee products contribute significantly to resources of household. Apiculture activities even create environment useful for sustainable development (Bradbear, 2004). Other great advantage of keeping bees is crops pollination. Bees pollinating vegetation provide an essential service for both natural and agriculture ecosystems. More than 80 % of crops are adapted for insect pollination and some of them are even existentially depended on it (FAO, 2014). Therefore beekeeping significantly creates and increases yields, quality and market value of agriculture crops (Klatt, 2013). According to study from 2007 around one third of global crop production is depended on animal pollination, means mainly insect (Klein, 2007). However, the management of beekeeping in Ethiopia faces many limiting factors such as a shortage of bee forage, predation by pests and residues of DDT sprayed on the forage (Ejigu, 2009). Several species of predators such as lizards, birds, snakes and ants were also detected as potential threats in beekeeping management (Jawo, 2013). Few governmental and non-governmental organizations offer practical support in the

implementation of advanced means of apiculture for landless and small farm households in the area of this study. This study focuses on analysing the financial benefit of honey production while considering its off-farm income potential in rural households in Southern Ethiopia.

1.1. Beekeeping practices in Ethiopia

Beekeeping practices reach deep into the history of Ethiopia. Knowledge of traditional techniques is transferred from generation to generation (Bogale, 2009). Honey production plays a very important role in the culture and religion of rural people in Ethiopia. Around 1.7 million rural households keep bees in their gardens as an off-farm activity (Wolfaardt, 2013). Ethiopia is also considered as fourth country in the world with highest number of bee colonies after India, China and Turkey. Average number of beehives between years 2002-2007 was estimated to 4,408,451 annual bee colonies which cover 6.08 % of total number of beehives worldwide (Cvitković *et al*., 2009). Indigenous knowledge is considered more and more important for appropriate sustainable development and its practices (Samal *et al*., 2010). Indigenous beekeeping knowledge, practices and its importance for understanding the apicultural sector in Ethiopia are crucial factors of beekeeping management (Bogale, 2009). Bees are important not only for honey production but also for pollinating plants and improvements in the quantity of the yield of certain crops (Crane, 1990).

1.2. Honey bee *Apis Mellifera*

Few varieties of honey bee specie *Apis mellifera* are used in apiculture (Hussein, 2001). The honey bee occurs naturally in a great range of habitats and climatic zones across Europe, the Middle East and Africa except for the desert regions (Crane, 1990). That has resulted in the evolution of many different honeybee subspecies that each with their own biological and behaviour variations depending on unique environmental adaptations. It means that one subspecies may do well in one location but not necessarily

in another. The race used can have a considerable impact on practical beekeeping. Main local varieties include *Apis mellifera scutellata, Apis mellifera jemenitica,* and *Apis mellifera simensis* (Galmann and Thomas, 2012). Abyssinian primitive apiculture practices originate in Egypt. Honeybee *Apis melifera fasciata* probably existed there (Hussein, 2001). Difference between European honey bees from the same species is the distance between the centres of a comb to the centre of the next comb for example; the space is around two millimetres smaller in the combs of African *Apis mellifera* bees compared to the European races of *Apis mellifera* (Bradbear, 2009).

1.3. Traditional and modern beekeeping management

Beekeeping in Ethiopia is divided into West, South and beekeeping practices of the rest of Ethiopia. Two main types of beehives are used in the SNNP region: the traditional and the modern. This study focuses on differences and similarities between them in the terms of income. Nevertheless there are constructional and operational differences which must not be overlooked.

1.3.1. Traditional beekeeping

Traditional beekeeping is the oldest type of keeping bees in Ethiopia (Legesse, 2014). In Ethiopia it is viewed by local farmers as man's activity although few women are also involved in beekeeping practices. That is because it is based on hanging hollow tree cavities on trees to establish the bee colony (Bradbear, 2009). Average age of beekeeper is between 50 and 60 years with more than 15 years beekeeping experiences. Specific knowledge is mostly transferred via families (Bogale, 2009). Level of education of average beekeeper is quite low. Bogale study (2009) shows educational level of beekeepers. More than one fourth of interviewed beekeeping farmers were unable to read and only 5.8 % of beekeepers had chance to finish the high school. Therefore the level of formal education does not really matter in traditional beekeeping practices (Gichora, 2003). Beekeepers basically make traditional beehives creating hole into log of *Acacia spp.* and other.

Traditional beehive is therefore not difficult for construction and the price of hive is usually not more than 0.25 USD (Bezabeh, 2004).

1.3.2. Modern beekeeping

The first initiatives in the dissemination of modern beekeeping began in 1977 in Gambella with support from the European Development Fund (Hussein, 2001). According to Girma *et al*. (2008) extension activities in beekeeping started in 1978 in Ethiopia and many efforts were made to train beekeeping specialists with improved knowledge and the distribution of the equipment for improved beekeeping practices. In 1988 two projects '*Land Potential of Coffee, Oil Crops, Apiculture Component' and 'Assistance in Apiculture Development'* were established to increase the production of honey through the introduction of modern beekeeping practices (Hussein, 2001). Short-, medium- and long-term development and marketing plans for honey production were formulated covering a period of 10 years by the Ministry of Agriculture and Rural Development – Animal and Fisheries Development Department - in 2010 (Chanyalew, 2010). 256 Woredas were selected as the potential areas for high levels of honey production using improved box hives, aiming to increase income and ease management. In addition, there was an expectation of 149,000 extra tons of honey being produced over the period of 10 years (MoARD, 2003). Modern hives were introduced to improve the quality and quantity of natural honey and to simplify honey production. Traditional and modern hives differ in price, materials, shape, management of use and the potential production per hive per season (Shenkute *et al*. 2012). In Ethiopia nowadays there are many organisations giving loans to the beekeepers to start or improve their beekeeping conditions via modern box hives. According to Yirga (2011) the modern beekeeping practices allow honey bee colony to work on higher level of technology and management. Adoption of this modern technology is mainly depended on the difference in profitability from traditional and modern beehives (Schultz, 1995).

1.4. Honey production

Ethiopia is considered as the biggest producer of honey in Africa and worldwide. The climate conditions of the South Nations, Nationalities and Peoples' Region (SNNPR) are ideal for the production of honey and bees' wax. The SNNPR's population is around 17 million people, of whom 13 million are farmers. Region SNNP presents 22 % of Ethiopian honey production (EHBPEA, 2013). 70 thousand farmers produce natural honey to sell (BoARD, 2012). There are also almost 1.5 million bee colonies in the region that produce 14,354 MTs of honey per year (2011/2012). More than 99 % of this honey is locally traded or used by households. Only around 0.5 % of production exported. In the period between 2005 and 2010 the production of honey increased by 13 % up to 45,300 MTs. Ethiopia exported 558 MTs of natural honey in the value of 2,106,000 USD in 2010 (FAO, 2010); the majority is exported to neighbouring Sudan and, since 2009, via Norway's development agency (NORAD) to Norway (USAID, 2012). 97 % of produced honey is sold formally and informally by small-scale farmers at local markets or to cooperatives in the districts (Woredas) and 85 % of that is purchased by brewers of *tej* (honey wine). Income which is generated in beekeeping sector is very low, because of the low productivity and poor quality of honey produced. Other constraint is seen in minimal access to markets, which forces beekeepers sell their honey locally at low prices (Shekhar, 2011). Only 2 % of Ethiopian honey is produced in modern beehives (13,060 beekeepers); the rest in traditional hives (BoARD, 2012).

1.5. Marketing of honey

Due to growing demand for honey from Europe there is still unused potential for Ethiopian honey to be marketed. In order to connect Ethiopian Honey Sector with partners worldwide there were organized promotion events (SNV, 2008). In 2008 country got the accreditation to export the commodity to EU market. The export of honey to EU therefore increased from 1.5 tons in 2000 to 275 tons in 2008 (Assefa, 2011). It resulted in creation of new business relationships among others for the export of honey to the EU.

Netherlands Development Organization (SNV) concretized meetings of important stakeholders to create opportunities after listing Ethiopia at EU accreditation for the imports of Ethiopian honey. Four honey processors started operate in the production areas. BOAM (Business Organizations and their Access to Markets) facilitated the training of rural producers who are now entering into out grower agreements with processors in order to produce honey according to market requirements (SNV, 2008). Even though Ethiopian beekeepers still widely use traditional methods and because of that fact majority of honey is consumed in the locality where it is produced. There are estimated around 5 million of beehives in Ethiopia. Approximately 1.4 – 1.7 million of households are keeping the bees (Desalgne, 2012). These are mainly small holders managing in small scale productivity. From overall production of honey 85 % is processed to make local honey wine '*tej*' (Sisay, 2011). Only minimal part of the beekeeping covers bee wax production. Therefore only 15 % is marketed domestically or exported as table honey (EHBPEA, 2014). Ethiopia has potential to produce 500,000 tons of honey and 50,000 tons of bee wax per annum. Nevertheless current annual production is 43,000 tons of honey and 3,000 tons of bee wax (Sisay, 2011). An average of Ethiopian birr ETB= 420 million (equal to 21.61 million USD) is obtained annually from the sale of honey, both in local and world markets (Abebe, 2008). Nowadays the strategy for scaling up the income generation from beekeeping is production of quality and high yield of honey, value adding to increase volume to supply the newly developing market through the private processing company (Legesse, 2014). Due to many challenges in Ethiopian market sector stakeholders established in 2005 honey trade association named ApiTrade Africa which is member based non-profit generating company. The role of the organization is to promote African honey widely, break down barriers hindering access to global markets, and ultimately unlock the potential of the apiculture industry to generate wealth (ApiTrade Africa, 2014). Market channels from beekeeper producing honey in Ethiopian highlands to urban consumer are facing few obstacles. Difficulties of transportation of honey out of the villages into the towns are extremely high and such a process is very expensive. Problems generally include the high cost of transport, low volumes per household and irregular interaction with traders (Bees for Development, 2006). One of the companies

supporting honey marketing in Ethiopia is German ProFound. In March 2014 in Addis Ababa took place three-day workshop focusing on marketing strategies for bee products in Ethiopia. The first participants of the workshop have already visited the Biofach 2014 in Nuremberg, Germany, for a matchmaking tour. Big interest was showed in Ethiopian bee products by the importers. One of the largest importers even expected Ethiopia to become Europe's major honey sources within the next years (ProFund, 2014).

1.5.1. Honey Value Chain

Since 2005 there are some interventions by Government and NGOs to create value chain in apiculture sector in Ethiopia. Establishing of several cooperative groups such as the Honey Value Chain Coordination Group in 2005, the Ethiopian Honey and Beeswax Producers and Exporters Association (EHBPEA) in 2008, Apiculture Board in 2009 helped to develop the base for improvement of honey marketing (Aseffa, 2011). Furthermore, BOAM created partnerships with international organisations like the Fair Trade Labelling Organisation (FLO) to enable farmers and agro-processors to export organic fair trade honey to international markets (Desalgne, 2012). The Ethiopian Government has approved Apiculture Resources Development and Protection Proclamation in 2009. The main goal was to promote household and commercial beekeeping development in areas of high apiculture resource potential (MoARD, 2009). The value chain created attracted many private companies into the apiculture sub-sector. In 2008, 17 companies were registered to engage in honey and beeswax processing and marketing. Nine of them already started processing and marketing. Some of them have even established out grower schemes with small-scale beekeepers (Aseffa, 2011). After several years of support of BOAM the honey value chain has developed to export quality table honey. Most of the actors in value chain indicated that the situation is ready to take off and exploit the full potential with making additional investments. SNV and its partners Ethiopian Apiculture Board (ETB), Triodos facet and Profound developed a 5 years up scaling program called ASPIRE (Apiculture Scaling-up Programme for Income and Rural Employment) funded by the EKN (Embassy of the Kingdom of Netherlands). The first

phase of ASPIRE started 2013 and is planned to finish 2015. In this three years phase ASPIRE will financially support innovations or models in export market development. Because of the relative weakness of apiculture sector, ASPIRE is expected to be refresh and bring together value chain partners and support them. The up-scaling is not realised by ASPIRE funding, but through commercial financing and public-private support mechanisms (Desalgne, 2012).

1.6. Constraints to beekeeping and honey production

Ethiopian small-scale beekeepers face many obstacles while doing beekeeping. There are many organisations for support of the beekeepers in rural areas of Africa, but not many scientific papers are written describing exact constraints affecting beekeeping farmers on African continent. Main constraints include lack of beekeeping equipment's, shortage of bee for colony, high cost of modern hive, pests and predators, lack of training, shortage of bee forage, shortage of water and colonies absconding (Yemane, 2013). Obstacles for managing the beehives also include lack of technological knowledge. Farmer's willingness to learn about new technologies and proper usage of these skills are the main factors affecting adoption of modern beehives. Lack of skill on managing modern beehives is considered as the biggest problem according to 75 % of beekeeping farmers in study from Oromia region. Important problem for adoption of improved beekeeping technologies which proves the lack of maintenance skills is bee absconding from hive (25 %), (Gebiso, 2010). The biggest constraints according to beekeepers are herbicides and pesticides (61 %) and bee predators (50 %), (Gebiso, 2010). Also windbreaks are the regular necessity for the bee colonies to produce surplus products over their requirements (Anderson *et al*., 1983). Necessary is also to make supering, i.e. putting additional beehive at right time to extend the bee colony. Proper colony management activities involve practices that harmonize with the normal behavior of bees and bring the colony to the maximum population strength at the start of the bloom of major nectar producing plants (Wakjira and Woltedji, 2006). Appropriate management can bring to the farmers even 50-60 times higher honey harvest (Root, 1976). Main

constraints disallowing proper beekeeping management presented in studies from India and Uganda are listed below. Case study from India published in 2011 analysed the main obstacles facing beekeepers in India. Greatest obstacles include pests, pesticides and diseases, bee forage shortage, lack of available credit, extreme weather conditions, lack of institutional support of market and vocational trainings (Monga and Manocha, 2011). In Uganda were published constraints of beekeeping by Mujuni *et al*. (2012). Among the main of them include lack of improved equipment, pests, weather conditions, lack of initial credit, fear of bees, poor extension services and lack of appropriate knowledge. Study also shows the fear of bees as the biggest obstacle for adopting improved hives in the locality (90 % of beekeepers mentioned it in the survey). Majority of constraints are in accordance with study from (Kalule, 2014) although he mentions as big obstacle inappropriate management skills and adds inadequate forage material, low productivity and impossibility of further honey products marketing. Generally said the constraints facing beekeeping management in developing countries can be divided into four categories: biological, technical, trade and institutional. Biological consist of all possible predators affecting beehive or the colony such as mammals, insects or viruses. Technological obstacles contain of lack of knowledge about how to manage beehive properly and also lack of trained professionals. Trade in developing countries mainly suffers from distance of producers and suppliers, traders and technical advisors. The root of the issue of trade constraint is in often but small volumes of products and difficulties with marketing. The last one, institutional constraint is mainly described like weakness of producers and lack of personnel to industrialize, certify and monitor the honey and bee wax production (FAO, 2004). Studies (Beyene 2008; Yirga *et al*. 2011; Shenkute *et al*. 2012) of beekeeping in Ethiopia describe the management of honey production, honey composition, the marketing of honey, the greatest limitations on, and the prospects for beekeeping. This study presents the share of traditional and modern beekeeping techniques in total household income and the most significant issues reported to be facing beekeepers in the area of study.

2. Aim of the Thesis

The general goal of our study was to analyse the conditions and compare traditional and modern beekeeping techniques of farmers in terms of annual income per household in Angacha Woreda in the Kembata Tembaro Zone in Ethiopia. Additionally study aims to find and describe the major constraints facing beekeeping farmers under local conditions. Purpose of this study is also to prove or disprove the tested hypothesis mentioned below.

2.1. Tested Hypothesis

The first research question focuses on the influence of modern beekeeping management on beekeeping farmers in studied locality. The question is whether modern beekeeping management is more appropriate and preferable for small-scale householders than traditional beekeeping management.

H1: *Modern beekeeping management is more appropriate and preferable for small-scale householders than traditional beekeeping management.*

We used similar structure of questions as in the study of Yirga and Terefi (2010) to identify the potential of beekeeping for rural development. Beekeepers were asked about their overall annual income, farm income and income from beekeeping specifically, the types of beehive in use, the number of seasons of honey production per year and honey marketing.

Shortage of bee fodder is the biggest constraint perceived by farmers in other regions of Ethiopia as mentioned by Yirga and Terefi (2010) and Abebe and Puskur (2010). The second research question concerns if the shortage of bee fodder is the biggest constraint farmers face in Angacha Woreda as well.

H2: *Biggest constraint perceived by beekeeping farmers in locality of study was shortage of bee fodder*.

The application of appropriate beekeeping management skills should bring a significant increase in beekeeping knowledge and contribute to properly develop beekeeping in Ethiopia further.

3. Methodology

To study beekeeping farmers, their economic situation and technological issues methods of contingency data analysis were chosen. In order to investigate the situation of beekeeping farmers in the locality in the terms of their economic conditions two types of data were collected. First, the semi-structured questionnaire was developed for the field survey. Second, aggregated data from various databases and case studies were compiled.

3.1. Secondary data sources

These data was studied before and during the primary data collection. Scientific databases were used to obtain the framework of the study in an appropriate scope. Databases (such as Web of Knowledge, Scopus etc.), individual journal archive databases and other sources available online were studied (e.g. *Journal of Agricultural Extension and Rural Development*, *Ethiopian Journal of Science* or *Journal of Livestock Research for Rural Development)*. Data available on web pages of Food and Agricultural Organization and the World Bank were used to get statistical background of beekeeping in whole Ethiopia. Key words used while gathering the information were: Ethiopia, beekeeping, traditional beehive, modern beehive. The statistical data from the Statistical Bureau and Research Centre in Hawassa supplemented an explanation of the state of the implementation of modern beehives in the area and beekeepers' attitudes to it.

3.2. Primary data collection – Field survey

Primary data was collected in the Angacha Woreda in the Kembata Tembaro Zone of the SNNPR in Ethiopia (see Figure 1). The dry period, so called *Tseday* season lasted from October to December in 2012. Three out of 18 kebeles of the Angacha Woreda were chosen based on their beekeeping potential as identified by the Woreda Agricultural Development Office (WADO). The kebeles Mesena, Chino Funamura and Special Angacha were studied from the perspective of traditional and modern techniques of beekeeping

and income from both of them. To conduct the study, semi-structured questionnaires, interviews, focused group discussions and simple observations were used.

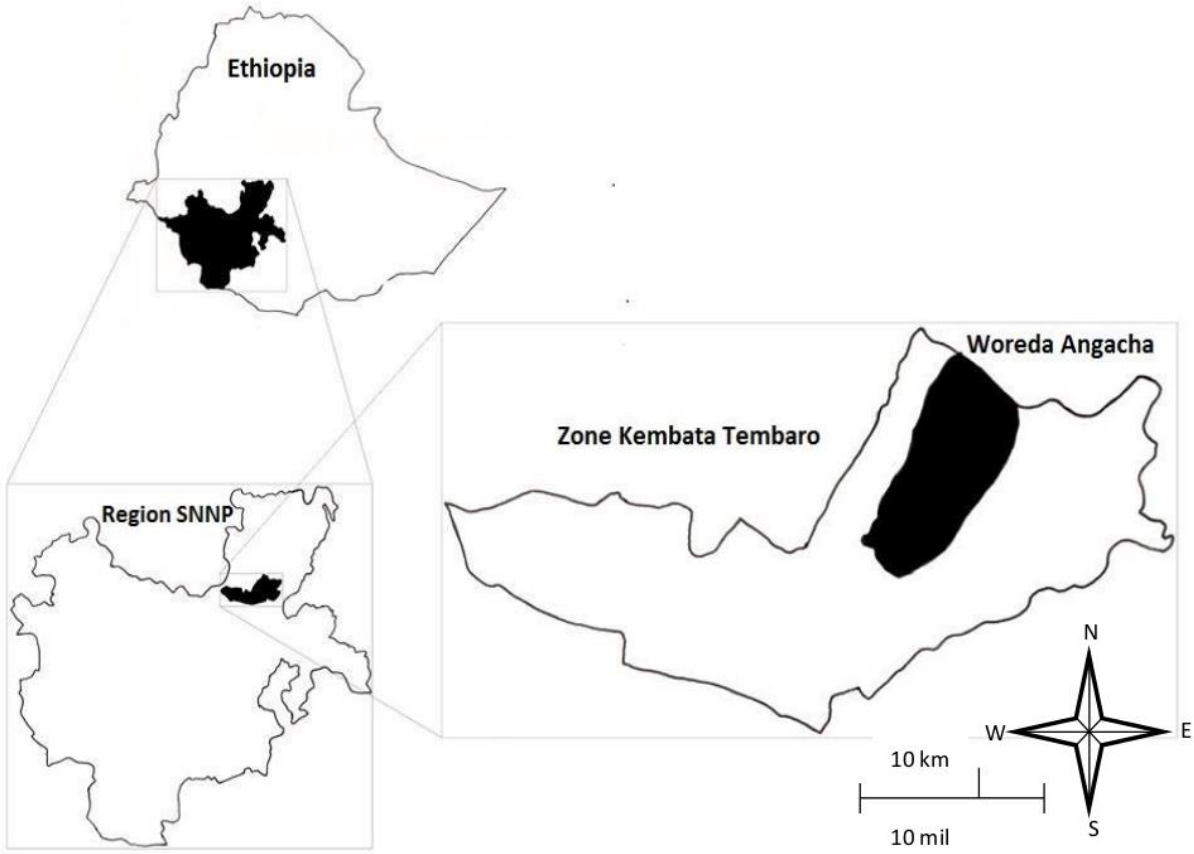

Figure 1 Map – administrative districts of studied area

3.2.1. Questionnaire

The questionnaire survey covered 92 small-scale beekeepers (38 % in Chino Funamura, 31.5 % in Mesena and 30.5 % in Angacha) that were selected by using the semi-random exponential non-discriminative snowball sampling method. While this provides little control over the choice of the sample, it allows approaching farmers who are otherwise difficult to access. Questionnaire consisted of 40 both closed and opened questions. Basic questions focused on socio-demographic background such as locality, age, gender, education in years, size of the family, number of members in household,

personal status, main crops cultivated and size of the plot were applied in order to create simple descriptive statistics and general statements. Other category of the questions focused on the types and numbers of beehives owned by household, ways of managing them, method of obtaining, price, market chains, distance from the market etc. These questions were followed by third type covering beekeeping products such as honey, wax and bee propolis harvesting, processing, storage, other usage and further marketing. In the end few questions were focused on Farmers' opinions and experience. There were some complementary questions to get a flexible picture of the reality of the indigenous communities present at the end of the questionnaire. Data was operationalized to simplify the reality for further statistically investigation. Regarding the structure, closed, open-ended, binominal, multinomial and scale questions were used. The adoption rate was calculated following the methodology of Gebiso (2010).

3.2.2. Interviews

Besides the questionnaire survey of small-scale farmers, interviews were carried out with officials on three administrative levels: (i) at the Woreda level – in the Woreda Office of Development and Agriculture, (ii) at the zone level – in the Bureau of Agriculture and Rural Development and (iii) at the regional level - in the Regional Bureau of Agriculture and Rural Development. In addition, we interviewed leaders of NGOs working in the study area such as *Kembati Menti Gezima* and *Food for Hunger*.

3.2.3. Local assistance

In order to translate the answers of the farmers and understand better the area of study local assistants with indigenous knowledge about the area and the local language, *Kembatigna,* took part in this field survey. Local assistants were trained in order to decrease possibility of misunderstandings and thus validity of collected data.

3.3. Data Processing

Collected data was analysed using the Statistical Package for Social Sciences (SPSS), version 20, 21 and 22. Both descriptive as well as inferential statistics were applied. Cross tabulation was used to generate information about bivariate relationships between selected variables (kebele, beehive type, number of seasons). There is used a sign scheme of adjusted residuals (the standardized difference between the observed values and the expected values) presented by + and – signs to ease optical orientation of significant differences; the scale of these differences is indicated by the number of signs. The phi coefficient of contingency was used to represent the level of the strength of relations in the contingency table. Inferential and inductive descriptive statistics serve to summarize and describe the data sample of the study.

3.4. Limitations of survey

The cultural difference can be seen as the main factor limiting this survey. Using interpreter for translation can also bring some misinterpreting in the results. Also some of planned interviews with authorities could not have been done because of different time perception and lack of free time of those.

4. Results

This chapter serves to provide the findings from the thesis research according to the aim of the study and hypothesis tested. For comparison purposes farmers were divided into three groups according to beehive type they possess. Three selected kebeles are illustrated with the numbers of beehive types farmers own. Simple calculation of annual income from each beehive is done and average price per one kilo of honey is estimated. In the end perception of beekeeping farmers indicates poisonous pesticides in one of studied kebeles.

4.1. Socio-economic and demographic profile of beekeepers

The survey included 92 respondents of which 90 % were male and 10 % female beekeepers. The mean age of the farmer was 45.2 years (±12.4). As to status of education, 63 % of beekeepers were literate and 36 % illiterate. The average length of the beekeeper's experience with bees was 14.4 years (±11.7). The average size of the farmers' field was 0.81 ha (±0.67), a factor which illustrates the lack of available land for crop cultivation and the potential for the development of beekeeping because of its small arable footprint. The initial impulse for farmers to start beekeeping and honey production was mainly family tradition (30.4 % of respondents), see Figure 2. Therefore more than half of the respondents (52.2 %) follow the traditional methods of beekeeping which prevail in the region. Other motivations involved the example set by the good practices of neighbouring beekeepers and/or the models used in either governmental or nongovernmental development programmes in the area. Almost a half of the interviewed beekeepers (46.9 %) have installed at least one modern beehive in their garden.

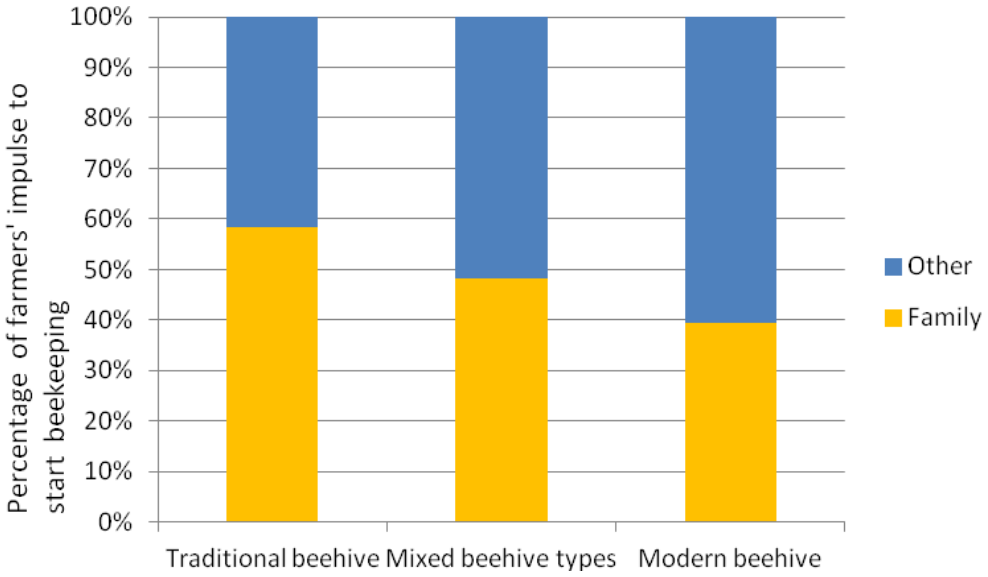

Figure 2 Initial impulse for beekeeping by type of farmer (%)

Inclination of traditional hive owners to start beekeeping by family impulse is 60 %. It is the same value of beekeepers which are suggested by others and own modern beehives at the same time. It confirms that traditional beekeeping techniques are mainly transferred from generation to generation and modern beehive owners are opened to get advices from others.

4.2. Beekeeping practices

All (100 %) of the farmers interviewed answered they are producing only honey. More than half of them (52.2 %) follow traditional beekeeping techniques only, 16.3 % use exclusively modern beehives and 30.4 % of beekeepers have both traditional and modern beehives (Annexes - Pictures 1-6). Out of 339 beehives in this survey, 81.4 % were traditional. The adoption rate for modern beehives therefore equals 18.6 %. Households own three traditional and 0.68 modern beehives on average. The distribution of beehive types used in each kebele is shown in Table 1.

Table 1 Types and numbers of beehives in selected kebeles (%)

	Traditional beehive	Mixture of types	Modern beehive	Total
Angacha	17.4	10.9	2.2	30.4
Chino Funamura	25.0	10.9	2.2	38.0
Mesena	9.8	9.8	12.0	31.5

In three kebeles selected for the research the number of beehives differs significantly. In Chino Funamura 25 % of beekeepers keep still traditional way of beekeeping in comparison with Mesena were more farmers using modern beehives (12 %). Further analyses were based on comparing farmers and their incomes in those two kebeles.

4.3. Access to market

Majority of beekeeping farmers had some further marketing opportunity. 81.5 % of farmers were selling their products or directly on local markets or to cooperatives. Figure 3 presents difference between selling practices in beehive types. While traditional beehives owners sell their honey on local markets farmers with modern hives produce honey to sell it to cooperatives. Some of the farmers were allowed to purchase of modern beehive by contract with cooperatives. Cooperatives redeem honey in special purchase price from farmers so beekeepers can than afford the modern beehive.

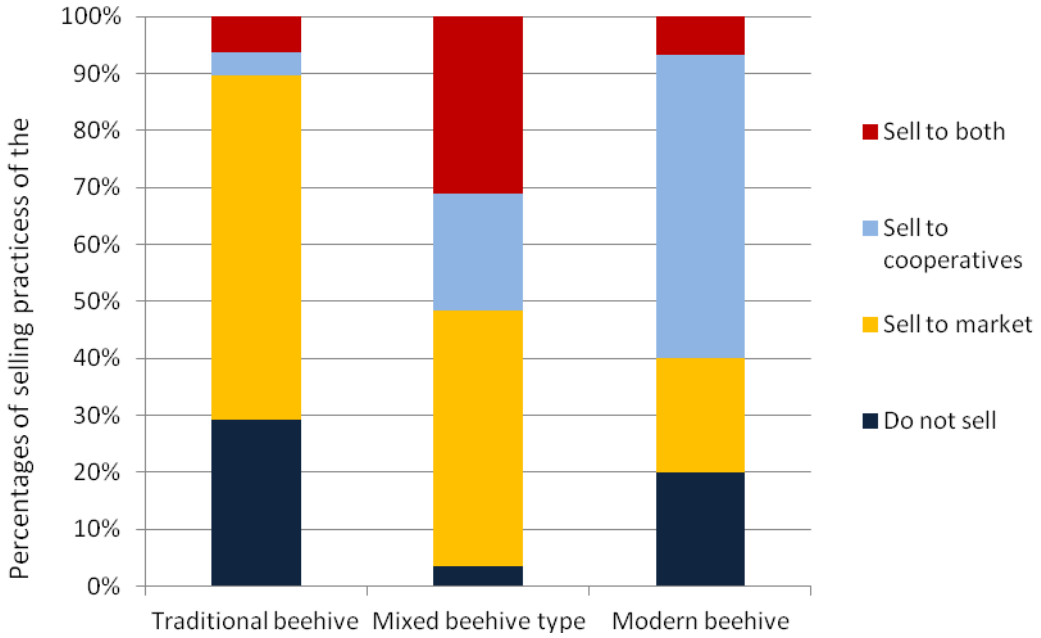

Figure 3 Farmers selling honey on markets and to cooperatives (%)

The majority of beekeeping farmers (81.5 %) sell their honey at local markets, to cooperatives or to other farmers with only 18.5 % keeping it only for household consumption (Figure 3). Majority of farmers who do not sell their honey to the market use it for medicinal purposes such as treatment of tuberculosis (77.2%), against coughing (65.2%) and for preparation of alcoholic drinks (92.4% - cheneto and 10.9% honey wine tej).

4.4. Beekeeping trainings

Authors of scientific articles often claim that beekeeping farmers almost do not attend special trainings on beekeeping (Kebede, 2007). While in this study farmers with at least one modern hive received training in more than 90 % (Figure 4).

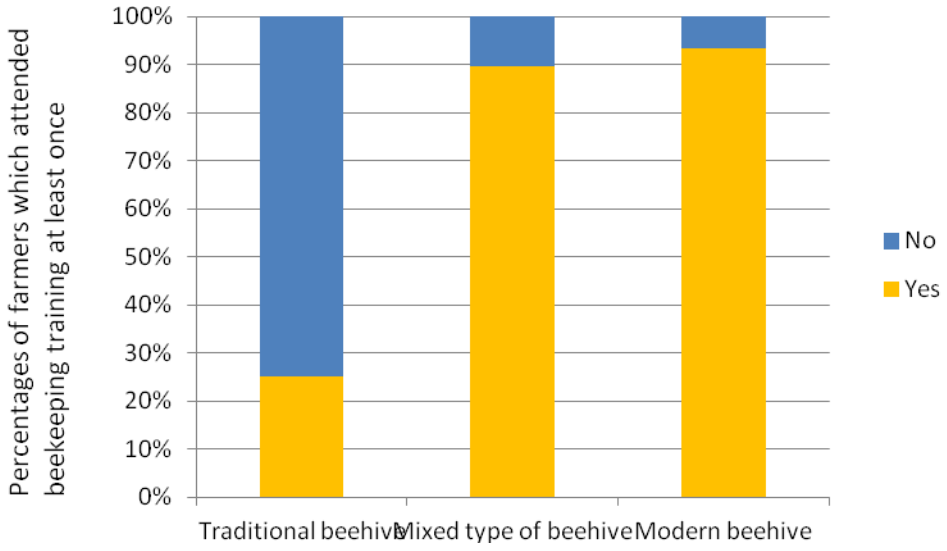

Figure 4 Percentage of farmer's attendance on beekeeping training

Training in innovations in beekeeping management provided by NGOs and WADO take place regularly in the area; 56.6 % of beekeepers have already attended at least one. However, this is clearly not sufficient if one takes into account the adoption rate of modern beekeeping (18.6 %) and little difference among incomes from each traditional and modern beehive. The seasonal averages for honey production were computed as a major measure of the effectiveness of any beehive.

Table 2 Seasonal honey yield and yearly income from each beehive

Type of beehive	Yield /season (kg)	Income/year (USD)	Share of off-farm income on farm income (%)
Traditional	1.9	44.6	24.0
Modern	4.9	43.8	23.0

The average annual revenue per household of both hive types was calculated to highlight the importance of honey production as a part of farmers' off-farm incomes (Table 2). Seasonal yield from a modern beehive was around 2.5 times higher than yield from a traditional hive. On the other hand, the income from honey per year is comparable in both types of hives due to variations in the number of harvest seasons (1-3 times per year). Beekeepers in the Mesena kebele have significantly more modern beehives than in other kebeles. There is, however, only one harvest season per year, in comparison with Chino Funamura where beekeepers use traditional hives and have more than one harvest seasons per year (usually 2-3 seasons). The results are presented using adjusted residuals in Table 3.

Table 3 Sign scheme – Comparison of count of harvest seasons and type of beehive by kebeles

	One harvest season per year	More than one harvest season per year	Traditional Beehive	Modern Beehive
Angacha	**0**	**0**	**0**	**0**
Ch. Funamura	_	+	+	_
Mesena	+ +	_ _	_ _	+ +

0 – not significant,

- Or + significant at α= 0.05,

- - or ++ significant at α = 0.01,

- - - or +++ significant at α= 0.001

Sign scheme presents that beekeepers with only one harvest season per year are more likely using modern beehives compared with two or more annual harvest seasons are more likely while using traditional hives. Therefore the annual income from both hives is comparable. Pluses and minuses in sign scheme present direction and number of signs shows strength of the relation between variables.

4.5. Share of beekeeping in annual off-farm income

The mean price of honey is 3.31 USD/kg and 3.05 USD/kg from a modern and traditional beehive, respectively. Our survey reveals that the average annual income in the Angacha Woreda is 188.9 USD. Income of off-farm forms 15 % (28.7 USD) per year. Based on the results of this study, off-farm incomes could be increased by 24 % - up to 44.6 USD per year under current conditions (Table 2).

4.6. Constrains to beekeeping

To meet the potential of beekeeping and improve the impact of honey production, constraints affecting the management of beekeeping need to be addressed. According the respondents, the main constraint is the issue of predators (Table 5).

Table 5 shows division of all mentioned constraints in each of three kebeles. Most of the farmers indicate the main constraining predators for beekeeping are ant, spiders and birds. Also varying natural conditions affect the beekeeping management significantly.

Table 4 Ranking of beekeeping constraints in selected kebeles

Constraints	Angacha (n=28)	Chino Funamura (n=35)	Mesena (n=29)	Total	Total (%)	Rank
Ants	28	34	29	91	98.9	1
Spiders	26	34	28	88	95.7	2
Heavy rains	26	29	29	84	91.3	3
Strong sunshine	26	27	29	82	89.1	4
Birds	24	29	24	77	83.7	5
Lizards	16	19	22	57	62	6
DDT	5	14	4	23	25	7
Fire	1	1	0	2	2.2	8

During the period of the study was also observed inappropriate management with modern beehives. The hives have been kept on inappropriate places with no bee colonies inside. Moreover, farmers did not know the importance of supering and requirements for its maintenance.

Farmers also mentioned the consequences of DDT (26 %) usage as the main hindrance to beekeeping; however, this differs according to kebele (Table 6). Significantly higher number of respondents indicated problems with DDT in the Chino Funamura kebele, which should lead to further research investigating the level of toxic pesticide usage in the area.

Table 5 DDT indicated in each kebele (%)

Kebele	No DDT indicated	DDT indicated by beekeeper	Total
Angacha	25.0	5.4	30.4
Chino Funamura	22.8	15.2	38.0
Mesena	26.1	5.4	30.4
Total	73.9	26.1	100

4.7. Decision making

In consequence of low awareness of and information flow concerning alternatives in rural Ethiopia there is a need to highlight the importance of decision making processes and training. Our research reveals that mostly men work on beehives (98.9 % of respondents), but decisions about the household (including the adoption of modern beekeeping) are made jointly by both men and women (95.7 %). The most convincing evidence for buying a modern beehive is the potential of higher honey production and thus higher income (50 % of respondents). Nevertheless almost half of the farmers never

get any advice about beekeeping (46.7 %). The Angacha Woreda still faces problems with an evident lack of functional training and extension policy and inadequate number of vocational personnel.

5. Discussion

Beekeeping can contribute to off-farm household income considerably if managed properly. The influence of family tradition is high. This study shows that the majority of honey is still produced in traditional beehives. And it should be therefore taken into account while implementing improved hives. The adoption rate of modern beekeeping in the study area has only reached 18.6 %, which is in accordance with findings by Shenkute *et al*. (2012) who consider the rate of adoption of modern beehives in Ethiopia to be quite low. His study shows that beekeepers have a great will to improve their beekeeping management if they are supported and convinced about the high yield of modern beehives. Gebiso (2010) found that, in the Oromia region, the adoption rate of modern hives is 21.95 %. In the SNNP region only 2 % of honey is extracted from modern hives (BoARD, 2012). However, almost half of surveyed beekeeping farmers (47.8 %) owns at least one modern hive. Differences in the adoption of modern beehives can vary within the country because of variations in natural conditions and in the level of knowledge about the bee management. The main potential for the development of beekeeping lies in its creation of additional (off-farm) income for the household. A household in the kebeles surveyed can earn 43.8 USD per year if it uses modern beekeeping techniques. This represents an increase in annual off-farm income of up to 24 % in the study area. It is up to 44.6 USD. Yirga (2011) stated in his study from the northern Ethiopia Asgede Tsimbla district that income from modern beehives can even amount to 161.5 USD (54.4 % of the local annual income). According to Beyene (2008), 42 % of farm households are self-employed or paid via off-farm activities. On average, farmers earn 32.7 USD per year from off-farm activities. Yirga analysed in 2010 that the modern honey production accounted 91 % of the potential annual income representing 27,623 USD. The extent of adoption of modern bee hives was 75.3 % which is much greater than the regional average of 31 %. In his study from Tigray region also majority (67 %) of randomly selected beekeepers were using modern beehive (Yirga, 2010). So much bigger share of modern beekeeping on total annual income from studies of Yirga and Beyene can have many different reasons. In the area of this study were significant cases of insufficient knowledge about modern beehives.

Even if 56.5 % of the farmers answered they have already been joining some kind of training (Table 4) on beekeeping topic in the area still remains inadequate information transfer. Study of Kebede (2007) from Adami Tulu Jido Kombolcha district in mid rift valley presents that 98 % of farmers did not have any opportunity to join some beekeeping training. Only one farmer has got training on general beekeeping practice so far. Also majority (76.7%) of beekeepers in his study consider as need to get advices or short term training about improved technologies to improve their beekeeping activities (Kebede, 2007). Our results show that average seasonal honey production is 4.9 kg and 1.9 kg per modern and traditional beehive, respectively. Honey production from modern beehives more than doubles the yield per season compared to that from a traditional hive, which remains four times lower than the yield that Gebiso (2010) found in the Arsi zone of the Oromia region. Local production in Oromia reaches 19.8 kg and 5.1 kg per season for modern and traditional hives, respectively. Differences in production depend on natural conditions in the area, limiting factors and farmers' attitudes to and knowledge of modern hives. Kebede (2007) says the average yield is 7.12 kg of honey per colony per year while the total production of honey is 35.51 kg/colony/year. It indicates both – potential of modern beehives and their easier harvest process and also lack of knowledge about appropriate harvesting methods (Kebede, 2007). According to Desalgne (2012) current honey production estimate represents only 8.6 % of the country's production potential. His study presents traditional harvest 5-6 kg per year and harvests from modern beehives are reaching levels of 18-30 kilograms per year. His data differ from those presented in our study mainly because of the different locality of the research. In study from Yirga (2011) is said the potential of modern beehives is harvest of 33 kg (16 kg) from modern (traditional) beehives which presents potential annual income of 33,248 USD and 7,980 USD respectively. Total income in the studied Endrta district would be maximally 454, 128 USD. He also says that the price of one kilogram of pure honey was estimated 6.5 and 5.8 USD. On the other side this study found price of honey is 3.31 USD/kg and 3.05 USD/kg. Kebede (2007) analysed that in Adami Tulu Jido Kombolcha district price of honey per kilogram ranges between 1.76 to 2.35 USD. It can differ because of the area of the research where the beekeepers were interviewed, selling opportunities, natural conditions and

insufficient knowledge about modern beehives management. Girma (2008) estimated gross investment for three sets of beehives and additional equipment for ETB 1407 (72.48 USD). Return period in Girma's calculations is minimally 12 months, because he counts with 17 kilograms per hive, two harvests and the price ETB 30 (1.55 USD) per kilogram. Therefore the net profit is estimated ETB 1653 (85.15 USD) for the first year and ETB 3060 (157.62 USD) for every following year (Girma, 2008). It is little more than with results in study of Abebe (2008) who analysed the income generation of 45 adopted modern and traditional beehives in Atsbi Wemberta (Tigray region). He stays maximal gross annual income for ETB 1350 (69.54 USD). Abebe counted the total equipment price for improved box hive 219.85 USD and 13.96 USD (1 USD was equal to 9.5 Ethiopian Birr in April 2008). The most expensive items on modern box hive are bee forage and labour cost, which are both almost for free in the case of traditional hive. Counted annual harvest is 27 kg from modern beehive which is approximately five times more than is presented in our study. Annual income in Angacha Woreda was estimated 44.6 USD. While counting on total modern beehive equipment 219.85 USD there would be return of initial investments almost five years. Jenkins (2012) calculated possibility of gaining 365 USD yearly after 5 years of adoption of modern beehives. With data analysed in our study this would not be possible. Terefi found that in Endrta district majority (52 %) of the beekeepers had more than 6 years of beekeeping experience (2011). Years of experience acknowledged by farmers in Northern Ethiopia differed by technology used. Traditional beekeepers were 11 years experienced and Modern beehives were used by beekeepers with 17 years long experience. Bogale (2009) says that beekeepers from Bale highlands in his study were more than twice more experienced - 15 years experienced in average. It is in accordance with our results that average beekeeping farmer is operating already 14.4 years in average. Comprehensive and properly conducted training in modern beekeeping positively influences the adoption process (Gebiso, 2010). More than half of beekeeping farmers in this study (52 %) attended at least one course in beekeeping, which now seems to be insufficient due to the low adoption rate. Yirga et al. (2011) mention low training attendance rates in the Tsimbla district (36 %) leading to a low adoption rate. Bogale (2009) comments that in the Agarfa, Dinsho, Goba and Sinana districts of the Bale

highlands none of the beekeepers went through any training and none of them has a modern beehive. The Farmers surveyed (98.9 %) perceived predators and weather patterns as the main limiting factors affecting beekeeping in the region which is in accordance with the findings of Hartman (2004) in south-west Ethiopia, Yirga and Terefi (2010) in northern Ethiopia in the eastern Tigray region and Shenkute *et al*. (2012) in south-west Ethiopia (the Kaffa, Sheka and Bench-Maji zones). Other authors agree that the main constraint on beekeeping in Ethiopia is the shortage of bee forage – Kerealem *et al*. (2005) and Ejigu *et al*. (2009) in the Amhara region, Gebeyehu *et al*. (2007) in the Oromia region and Terefi et al. (2010) in the Tigray region. In Kebede's study (2007) about 46.5 % of the respondents indicated that shortage of food and water were the serious problem than others and they are mainly responsible for absconding and/or migration occurred in the area. It is in contradiction with results of this study, where shortage of forage and water was not even mentioned by farmers (Table 5). This difference can be because of different natural conditions of areas of researches where the beekeepers were interviewed. Kebede (2007) also mentions predators such as varieties of insects, birds, spiders, monkey or apes, honey badger and lizard. Beside apes and badgers attacking the beehives it is the same what farmers mentioned in this study. Lack of knowledge about how to manage improved beehives observed in this study is in accordance with study of Kebede (2007). Insufficient knowledge about importance of supering of the beehives seems to be one of the great obstacles farmers are facing in the area of study.

This study opens the discussion about DDT (Dichlorodiphenyltrichloroethane) as an important obstacle impeding sufficient honey production. The farmers surveyed believe that DDT residues still remain in the soil. Residuals of DDT are persistent and stay in the soil more than 10 years (Hussen *et al*., 2006). The toxicity of DDT for both humans and animals led 237 nations (including Ethiopia) to sign the Persistent Organic Pollutant (POP) treaty in Stockholm in 2004. POP banned the use of DDT on a large scale, but allows DDT usage for 'disease vector control' under certain conditions (Hussen *et al*., 2006). In Ethiopia, DDT is used for malaria control. Issue about usage of DDT is very controversial for Ethiopian situation. Proper handling, storage, and disposal of unused DDT have effect on occupational health, environmental impact and logistical challenges. In recent years

even the mosquitos transmitting malaria are becoming more and more resistant (US AID, 2013). There are no doubts about how pesticides are harmful to bees. Nevertheless those chemicals are being used in increasing amounts. Companies making such pesticides do not deny their direct toxicity to bees, and when sprayed on the fields when bees are foraging it can causes high levels of contamination hive food sources (PAN-UK, 2012). In the study of PAN-UK was surveyed the DDT is still used by 30 % of the Ethiopian farmers (PAN-UK, 2010). Several cases of human and animal poisoning from residual DDT have been recorded (PAN-UK, 2003). Amera (2008) studied the awareness of the risk of DDT application to cotton fields in Ethiopia; the results show that 27 % of trained and 14 % of untrained smallholders, respectively, heard about incidents involving DDT poisoning. Only a few studies are known about the effects of DDT residuals on bees. The study from McGregor and Vorhies from 1947 shows effects on bees close to cotton fields dusted with DDT in Arizona. As little as 0.05 % concentration of DDT can affect a bee's hormonal system and kill the bee. Our study highlights the DDT problem in the Chino Funamura kebele which could significantly affect beekeeping management and negatively influence the quality of the honey produced. Blasco *et al.* (2003) found traces of DDT in 20 % of samples of honey from Portugal and Spain. DDT usage is global issue which is spoken all over the world and the Guardian magazine labelled neonicotinoids as new DTT, ’killing everything alive’, especially bees and other organism (Monbiot, 2013). According to Arnason Robert it is not even comparable with DDT, which was extremely persistent (Arnason, 2013). Anyway one of the biggest challenges while being managed or disposed in Ethiopia is presence of around 1300 tons of remaining DDT. Therefore the laboratory analyses of soil and honey samples from the area of Chino Funamura are recommended.

6. Conclusion and recommendations

Despite the incentives provided by both governmental and non-governmental organizations focused on modern beekeeping extension and despite favourable natural conditions in the Angacha Woreda, the adoption rate of modern beekeeping techniques in the region remains low and production potential unused. This study reveals a lack of conviction of the financial benefits to be derived from the use of modern beehives, indicating a knowledge gap among beekeepers. However, farmers showed their willingness to attend training. Lack of bee fodder is not perceived as the main constrain according to farmers. Beside many nuisances for beekeeping such as predators other obstacles limiting technology of honey production were found. Illegal pesticides usage should again become a subject of discussion and there is need to take the risk of malaria into consideration. The reduction of identified limiting factors would contribute to an increase honey production and the dissemination of modern beekeeping in proper way. There is need to develop better basis for beekeeping trainings. Inviting professionals to make vocational trainings focused on concrete problems of beekeepers is suggested. An enhancement of extension activities in terms of practical demonstrations, regular consultancies and the establishment of farmers' cooperatives are recommended.

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Annexes

Annex I. Specimen of questionnaire:

While visiting beekeeping farmers in Angacha Woreda in SNNP region in Ethiopia, first the purpose of the visit was explained. It was followed by introduction of the research and explaining questionnaire. Questionnaire was in English and trained interpreter was translating farmer's answers.

1. Woreda:
2. Kebele:
3. Gender: F x M
4. Age:
5. Number of members in household:
6. Personal status: single x married x widow
7. Literacy: literate x illiterate
8. Education: no education x elementary school x high school
9. Total years of education:
10. Size of your field:
11. Number of plots:
12. Main crop cultivated:
13. Which type of beehives are you using?

a. Traditional
b. modern

14. How many of which one?

a. Traditional:
b. Modern:

15. Where did you get the beehives? Which one from where?

a. Made by yourself
b. Somebody gave you? Who?
c. Did you buy them? For how much which one?

d. Other . . .

16. When did you start with beekeeping? How many years ago?

17. After how long time did you have the first production?

18. Why are you using this type of beehive? You can select more options:

a. Lower initial price
b. Easier providing
c. Other farmers have the same
d. Other . . .

19. Who told you about beekeeping?

a. It is family tradition
b. Other farmers
c. Model farmer
d. From DA's
e. Other . . .

20. Who from your family is the most working on beekeeping?

Woman x man

21. Who in your family is decision maker?

a. Man
b. Woman
c. Both together

22. How long time do you spend by caring about beehives per day?

a. If there is no enemy . . . .
b. If there is enemy . . . .

23. What are the enemies in your beehives?

a.
b.
c.
d.

24. What are the main problems destroying the beehives?

25. What are you producing by beekeeping?

a. Just honey (black, white or redish)
b. Honey and wax
c. Honey, wax and propolise
d. Other . . .

26. Your products from beekeeping

a. I do not sell them, because

26.a.i. I use everything for my own consumption
26.a.ii. Other . . .

b. I sell the honey in bottles of .....(Kilos or grams)/ one bottle

27. Do you eat (do your family eat) your honey? (you can select more options)

a. I do not eat the honey, i am just selling it
b. I eat raw honey i am producing
c. I am processing the honey more

27.c.i. How are you processing it?

28. What is the advantage of eating honey? You can select more options:

a. I use it for medical purpose. For what?

b. I use it for celebrations? How?

c. Other . . .

29. If you sell your products: where do you sell them?

a. On the market in ……..and it is ..... (time) of walking from my house
b. To cooperatives (is somebody coming to buy your honey?)
c. To other farmers
d. Other . . .

30. For how much are you selling the honey in good season?

1 kilo (or bottle)/.....birr

31. How many seasons are you producing honey per year?

32. How much honey do you produce from one beehive per one season – 1 kilo (or bottle)?

33. When someone is giving you an advice you, what is (would be) important about him? (you can select more options)

a. He is on high profession position
b. I have already have good experiences with him before
c. The advisor got specialized training
d. I do not trust him
e. Other . . .

34. Have you been on some special training about beekeeping?

Yes x No

35. How long time did it take to accept the new beekeeping technology?(Since the time you heard about beekeeping till the time you had your own beehive)

36. Beehives you would buy:

a. Beehive for 50 birr and spend to 20 minutes in average per day by work on it, and have the harvest 4.5 kg/year and it can be more dangerous for the children and animals

b. Beehive for 900 birr and work on it 10 minutes in average per day and it and it has honey harvest 20 kg/year and it is less dangerous

c. I wouldn't buy any of them

37. Is it dangerous for you to work with bees?

a. It is dangerous because it can attack my family
b. It is dangerous because the bees can attack my animals
c. It is not dangerous

38. Did the bees ever do something to you? What?

39. Why would you buy the modern beehive?

a. It is giving better production
b. It is easier providing them
c. It is less dangerous
d. I already have modern beehives
e. Other . . .

40. What would be your suggest to improve the beekeeping?

Notes:

Annex II. Pictures

Pictures taken by author in the period of the research:

Picture 1 Example of traditional beehive hanged on the house

Picture 2 Example of modern beehive (yellow)

Picture 3 Example of traditional beehive

Picture 4 Modern beehives owned by cooperatives in Chino Funamura

Picture 5 Traditional vessel and way of honey processing

Picture 6 Woman beekeeper with her beehives

Annex III. Publications

Parts of this research were presented under supervision of Ing. Jana Mazancová Ph.D. on three conferences listed below and second prize in category "Individual needs and responsibility: New Ways to Sustainable Animal Production" was won.

WICHSOVÁ M, MAZANCOVÁ J, PEŠKOVÁ, L, DIRIBA H. 2013. Evaluation of Impact of Beekeeping Extension on Farmer's Livelihood in Angacha Woreda, Kembata Tembaro Zone, Ethiopia. 2013, Scientific Conference - Tropentag 2013: Agricultural development within the rural-urban continuum, September 17 - 19, 2013, Stuttgart-Hohenheim.

WICHSOVÁ M, MAZANCOVÁ J, PEŠKOVÁ, L. 2013. Economic Impact of Beekeeping Extension on Farmer's Livelihood in Angacha Woreda, Kembata Tembaro Zone, Ethiopia. 2013, ELLS Scientific Student Conference 2013, University of Natural Resources and Life Sciences, Vienna (BOKU), November 14 - 16 "Sustainability Challenge - Technological advancements and other solutions".

WICHSOVÁ M, MAZANCOVÁ J, PEŠKOVÁ, L, DIRIBA H. 2013. Evaluation of Impact of Beekeeping Extension on Farmer's Livelihood in Angacha Woreda, Kembata Tembaro Zone, Ethiopia. 2013, 7th Scientific Conference FTA, Czech University of Life Sciences Prague (CULS), November 28 – 29 "Economic aspects of natural resources management in tropics: Social capital and microfinance".