Journal of Agriculture and Environmental Sciences

Research Article

Challenges, opportunities and strategies for the establishment of beekeeping inputs producing enterprises in Amhara Region, Ethiopia

Asaminew Tassew[1] and Abebe Jemberie[2]*

[1]College of Agriculture and Environmental Sciences, Bahir Dar University, Bahir Dar, Ethiopia
[2]Mass Youth Employment in Apiculture (MaYEA) of ORDA Ethiopia, Bahir Dar, Ethiopia
***Corresponding author:** asaminew2@gmail.com

Received: October 9, 2024 Accepted: June 19, 2025

Abstract: *This study was conducted to investigate the challenges, opportunities and strategies for the establishment of beekeeping input-producing enterprises in Amhara region, Ethiopia. In this study, a total of 135 women beekeepers household surveys, 33 key informants, and 18 focus groups were addressed to collect primary data. Moreover, additional data was collected through researchers' observation and secondary data. The survey data were analyzed using SPSS version 20 statistical package while qualitative data were analyzed by thematic analysis method. The study showed that women have come to own an average of 5.18, 2.04, and 2.38 honey bee colonies in traditional, transitional and modern hives respectively. Moreover, 15.2% of the respondent beekeepers have confirmed that they have started beekeeping with the support from Oxfam. The results showed that 47.04% of the respondents have evidenced that the beekeeping inputs in use are obtained from Oxfam followed by beekeepers themselves. Furthermore, 80%, 77.8% and 82.2% of Mecha, Dangila and Guangua respondents respectively have explained that the cost of most beekeeping inputs is expensive. On the other hand, 75.6%, 55.5% and 62.2% of Mecha, Dangila and Guangua, respective, women respondents have confirmed that there will not be a market problem if a beekeeping input-producing enterprise is established in their area. Lack of access, high cost and sometimes qualities of inputs have been identified as challenges that women beekeepers are facing in the areas. However, encouraging market demand, increasing the number of beekeepers, availability of raw materials used in input production, and important support from Oxfam are identified potential opportunities in the study areas. As healthy beekeeping is necessary for both improvements in the productivity and health of agricultural and natural ecosystems, everyone anywhere shall better consider the support from sustainable and demand-driven input-producing enterprises.*

Keywords: Beekeeping inputs, Honeybee colonies, Women beekeepers
Citation: Tassew, A., and Jemberie, A**.** (2025). Challenges, opportunities and strategies for the establishment of beekeeping inputs producing enterprises in Amhara Region, Ethiopia. *J. Agric. Environ. Sci*. 10(1): 100-119. DOI: https://doi.org/10.20372/jaes.v10i1.10437

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1. Introduction

Ethiopia, as a potential honey and beeswax - producing nation globally and in the continent (CSA, 2020), has a longstanding traditional beekeeping practice. With this, it significantly contributes to increased off-farm income generation efforts towards poverty reduction (MoARD, 2007). Though the country has the potential to produce an annual amount of up to 500,000 and 50,000 tons of honey and beeswax, respectively, with its total colony

population currently, it is producing only more than 60,000 and 5,000 tons of honey and beeswax, respectively (MoA, 2012). Furthermore, Amhara region, one of the potential beekeeping regions of the country with an estimated number (1.4 million) of honey bee colonies, is contributing 19.5% and 25% of the country's colony population and honey production, respectively (Kerealem *et al*., 2009). Consequently, the sector has attracted attention from different stakeholders to be involved in beekeeping which has created a chance for rural jobless women and youths to work with bees. In this regard, non-governmental organizations like Oxfam-GB have worked to increase an opportunity for women and rural youth to engage in beekeeping as a means of income generation. For the accomplishment of its efforts, Oxfam-GB has tried to provide beekeeping inputs through credit services from their own cooperatives and various theoretical and practical beekeeping and business skill training which have given energy to participating women who successfully practice beekeeping.

The provision of beekeeping inputs, however, has been left aside to local livestock offices and cooperatives, where it is given less emphasis. The provision of these inputs to rural women may improve the livelihoods and women's roles in food security. It is therefore, an important activity to study, analyze and understand the status and possible strategies to be implemented in the establishment of beekeeping inputs producing and/or providing enterprises at representative locations of the study areas (Mecha, Daangila and Guangua districts). Hence, evaluating honey production, market trends, and value chain actors along with analyzing factors affecting farmer participation will guide targeted interventions (Melaku *et al*., 2008; Getahun, 2016) to identify improvement opportunities and strengthen beekeeping engagement.

Though most areas of the country and the region do have varied geography, culture, tradition, and potential to beekeeping, in most cases, rural households are not satisfactorily engaged in beekeeping activities where independent factor analysis needs to be conducted. Therefore, the aim of this study was to investigate the challenges, opportunities and strategies for the establishment of beekeeping input-producing enterprises.

2. Materials and Methods

2.1. Description of the study area

The study was conducted in three Oxfam beekeeping project intervention districts (Mecha, Dangila and Guangua) of the Amhara Region. Mecha district is found in the West Gojjam Zone, while Dangila and Guangua are in the Awi Administrative Zone (Figure 1). The land use types, climate, irrigation potentials, economic, and institutional aspects of the three districts are described in Table 1.

2.2. Sampling techniques and sample size

Purposive sampling was employed to identify the study districts, while kebeles were selected randomly and within each district a multistage sampling procedure was employed to select respondents for the survey work. In the first stage, three districts (Mecha, Dangila, and Guangua) were purposively selected as the districts are the Oxfam-GB project intervention areas. In the second stage, three rural kebeles from each district were selected randomly.

A total of 145 women beekeepers were randomly selected from three districts for the household survey, with 15 women beekeepers chosen at random from each kebele. In addition, 33 key informant interviews (KIIs) and 18 focus group discussions (FGDs) were carried out for this study.

Table 1: Summary of basic data of the study districts

Descriptions	Mecha	Dangila	Guangua
Land use types			
Land use (ha)	130,214.00	73,613.61	107,160.50
Arable (ha)	69,661.00	47,833.98	31,480.50
Non arable (ha)	29,792.00		28,956.00
Communal (ha)	6,517.00	12,260.00	
Swampy area (ha)	106.00		
Settlement (ha)	6,517.00	3,086.00	466.00
Forest (ha)	17,621.00	10,433.63	46,258.00
Climate			
Dega (Highland)(%)	20%		
Weyinadega (Mid-land) (%)	80%	100%	100%
Altitude (masl)	1800-2500	1980-2150	1600-1710
Temperature(^{o}c)	24- 27	24- 28	22-30
Rain fall (mm)	1000-2000	1200-1400	1300-1800
Irrigation potentials			
Irrigable land (ha)	21150.5	11,176.00	17,707.50
Irrigated land (ha)	7000	9,010.75	13,932.00
Landholding			
Land holding per HH (ha)	0.74	1	1.5
Household heads			
Number of women headed HH	9,584	6,767	
Men headed HH	52,816	22,781	
Fruit production in ha			
Avocado		8.00	
Mango		12.00	
Lemon		14.00	
Banana		17.00	
Coffee		258.00	
Institutional arrangement			
Number of honey Unions	0	0	0
Number of honey primary Cooperatives	1	1	1

Source: Agricultural offices of the three districts (unpublished)

2.3. Data sources and methods of data collection

In the course of the study, both primary and secondary data sources were employed. Primary data were collected through a questionnaire-based survey, KIIs, FGDs, and direct observations by researchers.

A semi-structured questionnaire was administered to a total of 135 women beekeeper farmers to collect data related to the socio-economic characteristics of the households, general beekeeping practices, and the opportunities and constraints in establishing beekeeping inputs-producing enterprises. The sampled respondents were interviewed by the researchers and trained enumerators, either in a central location close to the village or by house-to-house visits. The questionnaire was pre-tested to check its appropriateness and correctness in generating all the necessary information to meet the stated objectives and was fine-tuned after the pre-testing.

Key informant interviews (KIIs) were also held with women beekeepers, district beekeeping experts, livestock development agents, Oxfam district project facilitators, beekeeping input-producing enterprises, chairman of bee products processing cooperatives,

and chairman of Zenbaba union (Table 2). Open-ended questions were used, and the interviews were done using the local language (Amharic/Agew). Responses were recorded using a voice recorder. The interviews were done by the researchers with the help of a research assistant.

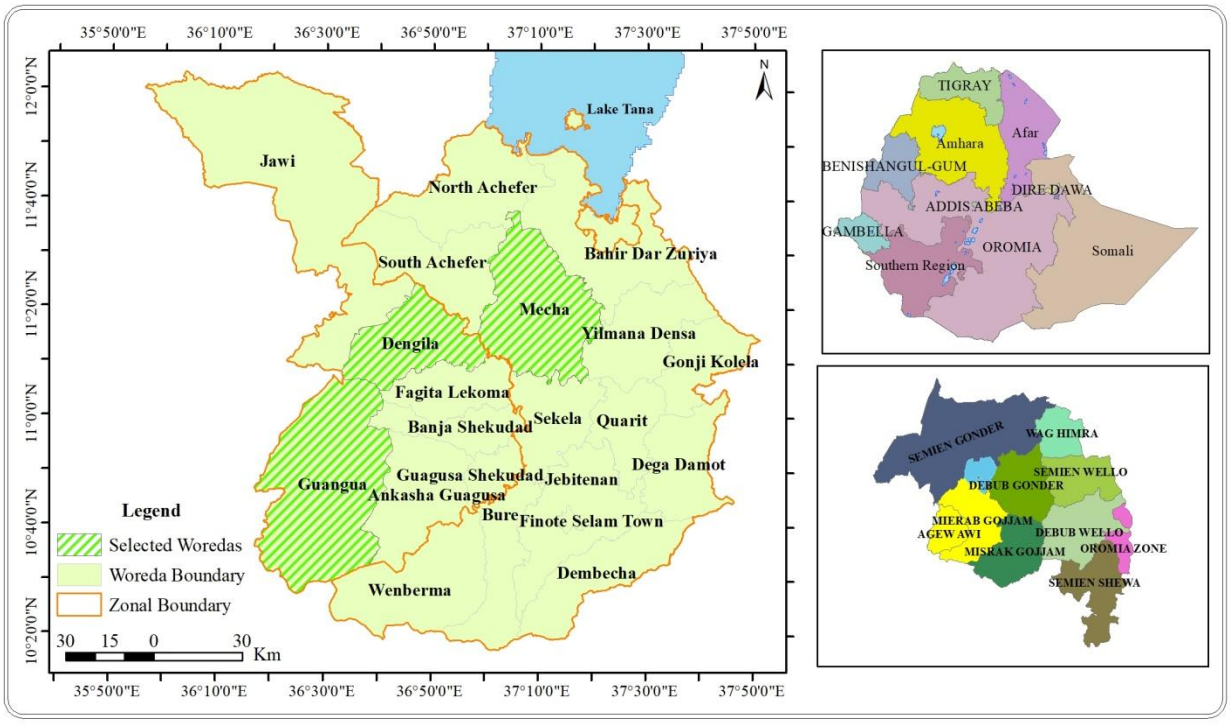

Figure 1: Map of the study districts

Table 2: List of key informant interviews

Interviewees	Number
Successful women beekeepers	9
Unsuccessful women beekeepers	9
District beekeeping experts	3
Livestock development agents	4
Oxfam district project facilitator	1
Beekeeping input producing enterprises	3
Chairman of bee products processing cooperatives	3
Chairman of Zenbaba union	1
Total	33

A total of 18 FGDs were also carried out with women beekeepers. The aim of the FGDs was to gain greater insight into the topics covered and validate the data collected through the survey. Open-ended questions were used to guide the discussions, and the discussions were conducted in the local language (Amharic/Agew). The discussions were done by the researchers with the help of a research assistant.

In addition to the primary data, secondary data were also collected from the Oxfam-GB office, the Amhara Region Livestock Resources and Development Promotion Agency, and the district offices of Agriculture, as well as from published and unpublished literature.

2.4. Statistical analysis

The household survey data were analyzed using the Statistical Package for the Social Sciences (SPSS) software program, version 20. The data collected from KIIs and FGDs were subjected to thematic analysis. In the thematic data analysis technique, the

analysis and interpretation of the raw data involved four stages. First, the qualitative data gained from the interview and focus group discussion were transcribed from the audio version into text form. The transcribed data were translated from Amharic/Agew into English. The translated raw data were then coded and organized based on their dimensions and were analyzed and interpreted qualitatively. The information gained from the quantitative data was integrated with the qualitative data using the triangulation technique.

3. Results and Discussion

3.1. Demographic characteristics of the respondents

The average family size of the respondents (beekeepers) was 6.26 with the female and male family member average sizes of 2.95 and 3.27, respectively (Table 3). Indeed, the results revealed that beekeeping in the study area has been practiced by all age groups (youngest-elders), mainly by the active working force age group which is substantially important and has the potential to increase apicultural production. The results concur with earlier findings (Tewodros *et al.*, 2015; Dereje *et al.*, 2016), who stated that beekeeping practice is learnt through parental guidance between generations and is practised by all economically active age groups (15–65 years old).

The majority of the respondents' age was in the age range of 20–60 years old with a mean of 37 years old, indicating that age is not a limiting factor for beekeeping, and beekeeping is playing a great role as a means of job and income generation. At the same time, the involvement of young people in the beekeeping activity is an opportunity for future expansion and development of the subsector, possibly as a sole business. Similar findings showed that beekeeping practice is learnt through parental guidance between generations and is practiced by all economically active age groups (15–65years old) (Dereje *et al.*, 2016).

Table 3: Family size and age of the respondent (Mean) in the study areas

Variables	Districts			Overall (N=135)
	Guangua (N=45)	Dangila (N=45)	Mecha (N=45)	
Female Family Member	3.30	2.81	2.70	2.96
Male Family Member	3.23	3.29	3.30	3.27
Total Family Size	6.53	6.02	6.20	6.25
Age	36.74	32.20	39.77	37.19

Table 4: Educational level of the respondents in the study areas

Educational Level	Districts							
	Guangua (N=45)		Dangila (N=45)		Mecha (N=45)		Overall (N=135)	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Illiterate	37	78.72	22	48.89	35	94.59	94	72.87
Read and Write	9	19.15	7	15.56	2	5.40	18	13.95
Grade 4 -6	0	0	10	22.22	0	0	10	7.75
Above grade 6	1	2.13	6	13.33	0	0	7	5.43

It is widely believed that the education level of household heads is a decisive factor in affecting the adoption of different technologies and improving agricultural productivity. As shown in Table 4, the majority (72.56%) of the respondents were illiterate. This shows that the education levels of female beekeepers are unsatisfactory in identifying problems in their beekeeping activities and seeking appropriate solutions thereby improving productivity and production. In this regard, Kerealem (2005) reported that the educational level of the farming households may have significant importance in identifying and determining the type of beekeeping development and extension services that should be provided.

3.2. Colony holdings, sources and honey yield

From the perspective of the levels of technology and management practices used by the beekeepers, three bee hive types were identified: traditional, transitional (top-bar hive), and modern (movable frame hive). The overall mean honeybee colony holdings per household were 5.18, 2.04, and 2.38 in traditional, transitional and modern hives, respectively (Table 5). The reported overall honey yield obtained from traditional, transitional and modern hives was found to be 7.34 7.47, and 14.04 kg per hive per year, respectively. This result indicates that frame and traditional bee hives have been poorly managed in the area which has very low productivity. This may be due to the fact that the technologies need better attendance than the traditional hives together with the lack of enough management skills among the women beekeepers. The findings of this study are comparable with the findings of other scholars (Bekele, 2015; Zewdie, 2017).

Table 5: Honeybee colony holdings and honey yield (Mean) in the study areas

Variables	Districts			Overall (N=135)
	Mecha (N=45)	Dangila (N=45)	Guangua (N=45)	
Colony holdings				
Traditional hive	3.88	2.66	8.32	5.18
Transitional hive	1.91	2.00	2.11	2.04
Modern hive	1.74	2.54	2.81	2.38
Honey yield per hive/year (kg)				
Traditional hive	7.75	6.74	7.56	7.34
Transitional hive	5.38	6.44	8.46	7.47
Modern hive	18.17	12.91	11.52	14.04

The study showed that 28.8% of the beekeepers started their beekeeping business by purchasing honeybee colonies from established honeybee colony market centers and/or from neighbor fellow beekeepers. About 26.5% of the beekeepers on the other hand got their started honeybee colonies by catching swarms followed by support from Oxfam (15.2%) (Table 6). This result revealed that honeybee colony marketing is a common practice in the study area. The current study is consistent with the results of Abebe *et al*. (2008) who stated that the beekeepers in Atsbi Wemberta get extra income from the sale of honeybee colonies.

Table 6: Sources of colonies to start beekeeping

Sources of colonies	Frequency	Percent
Bought from the market	38	28.8
Obtained from parents	10	7.6
Got it from loan	1	0.8
Swarm catching	35	26.5
Support from OXFAM	20	15.2
Bought from the market and obtained from parents	9	6.8
Bought from the market and got it from loan	2	1.5
Bought from the market and swarm catching	6	4.5
Bought from the market and support from OXFAM	7	5.3
Obtained from parents and swarm catching	3	2.3
Got it from loan and swarm catching	1	0.8

3.3. Women's participation in beekeeping

Apart from the traditional thinking and taboos, men are encouraging and supporting women to participate in beekeeping in all districts and some women have been confirmed to undertake different beekeeping activities confidently by their own. For similar reasons, women participation in beekeeping is also cited as a practice that has the potential to empower rural women (Pocol and McDonough, 2015). In this regard, though some of the beekeeping's technical activities like colony transferring, queen catching, moving honey bee colonies and harvesting are also sometimes difficult for men; few women beekeepers have explained that they are looking for assistance from men (Kebede et al., 2007; Qaiser et al. 2013). As a strategy, it was understood that OXFAM-GB and FC (Facilitator for Change) have been addressing these technical issues to help women through practical training and enable them to access the honey bee colonies in the backyard through credit to inputs and continuous awareness and job creations among women.

"A key informant from the study has clearly stated and explained that women's participation in such practical training and engagements in beekeeping as an activity owner who are majorly responsible for the improvement of the activities at Farmyard and explanation and sharing of experiences for possible changes has been tremendously encouraged as of Oxfam's intervention in the area. The implementation of these improvements was facilitated by FC, a local NGO under the supervision of Oxfam, in which women's participation has been scaled up through the establishment and use of self-help groups (SHG)".

Evidently, significant numbers of the respondents (42.22%) have explained that they have started beekeeping due to Oxfam's support in the area (Table 7).

Moreover, the majority of the beekeeping women interviewed in the three of the study districts have explained that Oxfam was the active participant in providing both the theoretical and practical trainings followed by government support through its extension services (Table 8).

Table 7: How do you start the beekeeping business?

Responses	Frequency	Percentage
Learnt from parents	28	20.74
Learnt from extension	6	4.44
Learnt from friends	13	9.63
OXFAM support	57	42.22
Learnt from parents and extension	11	8.15
Learnt from parents and friends	12	8.89
Learnt from parents and OXFAM support	8	5.93

Table 8: Who trained and supported you in producing beekeeping inputs locally?

Training provider	Districts					
	Mecha		Dangila		Guangua	
	Frequency	Percentage	Frequency	Percentage	Frequency.	Percentage
Indigenous knowledge and skill	7	15.56	6	13.33	5	11.11
OXFAM support	23	51.11	28	62.22	21	46.67
Governmental extension agents	15	33.33	11	24.44	19	42.22

"Very critically, when asked "What will happen if there was no beekeeping training provided by Oxfam?" a key informant addressed in one of the study areas replied that it was very difficult to think of such a positive and faster change in practicing beekeeping by women (which are more

appropriate to do the basic colony management issues at the backyard) in a sustainable way only through the involvement of the government in its extension services as those efforts made by the government were not targeting and addressing not only women but also determined beekeepers who are really in need of the training or participation in its process to capacitate and participate them in beekeeping"..

"Similarly, another beekeeping woman interviewed as a key informant to this study has confirmed that a continuous encouragement and training of women in selected skill and knowledge gaps for practicality of most beekeeping technologies (which has brought improvements both in average colony number and productivity per farmer) based on local conditions and season at farm-gates or closer destinations will tremendously support women beekeepers for sustainable improvement of household income through improving the productivity and diversification of hive products".

In support of the later key informant's explanation (witness), the general baseline data collected from a total of 4071 beneficiaries owing a total of 7357 with an average of 1.81 honey bee colonies per beneficiary before Oxfam's intervention in the study areas (Oxfam, 2015), while data collected in this study showed that sampled 135 beneficiaries own a total of 923 with an average of 6.84 honey bee colonies per beneficiary (Table 9). This investigation demonstrates that the project's intervention in the study districts has up-lifted the average colony holdings from 1.81 to 6.84. Moreover, the data illustrated that honey production per household also increased from 7.87 kg to 16.43 kg (Table 9). This was also explained during discussions with key informants and focus groups. The increase in average honey production per household might be due to increased colony management practices, the involvement of more workforces (which was previously men's duty) and the introduction of modern beekeeping inputs.

From all this information, it is clear to understand that sustainability and improvement of women's work quality and capacity in the beekeeping sector need to be strengthened and uplifted through the provision of practical training and continuous technical support.

Table 9: Comparison of colony holdings and honey production before and after Oxfam's intervention in the studied districts

Data source	Sample in number	Colony				Yield			
		Traditional hive	Transitional hive	Frame hive	Total	Traditional hive	Transitional hive	Frame hive	Total
Study data	135	632	96	195	923	829	321	1068	2218
	Average	5.18	2.04	2.38	6.84	7.34	7.47	14.04	16.43
Baseline data	4071	5974	488	895	7357	26476.4	2375	3196.5	32047.9
	Average	1.47	0.12	0.22	1.81	4.43	4.87	3.57	7.87

3.4. Status and use of beekeeping inputs

3.4.1. Beekeeping equipment and other accessories

Productivity and production form beekeeping, being one of the most important and integral part of the rural farming community not only in the study area but also in the country, is dependent on the use of different technical and operational inputs (Woldewahid *et al*., 2012). More specifically, overall (bee suit), bee veil, hand glove, boot, smoker, bee brush, water sprayer, chisel, knife, frame wire, casting mold, foundation sheet, beeswax, queen excluder, uncapping fork, honey extractor, hone presser, honey jar, and honey strainer (sieves) are known, one way or the other, to be used by the beekeeping farmers.

During the baseline survey, respondents preferred hives based on availability, affordability, ease of management, and honey yield, associating modern hives with better quality honey (Oxfam, 2015). However, the current survey revealed that respondents ranked traditional, transitional and modern hives in order of importance and accessibility in the area. This result indicates that frame hive management and its accessibility have been much more difficult for the women beekeepers than the transitional and traditional hives. Moreover, beekeepers have been concerned that bee colonies are disturbed in frame hives with the reason that beekeepers have shortage of inputs and a skill gap in managing this technology. As a result, many frame hives have been observed empty and occupied by different house items including clothes and explained as less productive hives than the other two.

In addition, the results from the focus group discussion has been found to be in line with Oxfam (2015), who stated that the degree of exposure and skill/knowledge of beekeepers in the different hive types has affected their preference too. Though the availability of beekeeping accessory inputs (honey extractor, casting mold and others) was good, and alternative use of beekeeping expansion techniques (trapping of swarms) was poor (Oxfam, 2015), it is found that beekeeping inputs provided to women beekeepers were not functional and/or misused. However, beekeepers are using the beekeeping expansion techniques such as swarm catching and colony multiplication which should be maximized through the use of trained beekeepers as technicians in a village or kebele to teach and demonstrate the technique to cope up with colony shortage or higher price which increased from 200 ETB to 1000 ETB in just 5 years. The various inputs needed for beekeeping are either obtained from the local market or supplied by various governmental and non-governmental organizations. According to the report made by Oxfam (2015) who explained that the extension system was providing 100% and 34% of the beekeeping inputs in Dangila and Guangua respectively. However, in a recent study, it was found that Oxfam was the highest (47.04%) input provider to women beekeepers followed by own purchase in the study area. The data collected from women respondent beekeepers in the study areas have revealed that beekeepers in Guangua are better than that Dangila and Mecha women beekeepers in using the available beekeeping inputs (Table 10).

Oxfam, farmer's cooperatives, beekeepers themselves, retailers, the Bureau of Agriculture (livestock agency), and research centers were identified as a source of the beekeeping inputs to the beekeepers in the study areas. Accordingly, 47.04% of the respondents interviewed have evidenced that the beekeeping inputs in use were sourced from Oxfam followed by beekeepers themselves (Table 10). This indicates that the beekeeping sector was poorly supported by stakeholders in providing beekeeping inputs other than Oxfam after its intervention.

Though beekeepers were not using the beekeeping inputs in the study areas, the majority of the respondents replied "yes" to the question forwarded to know whether they do have awareness of the uses of the beekeeping inputs. This has further indicated that the beekeepers in the study areas could use the beekeeping inputs if they could have access.

Regarding the possibility and/or potential of the respondents, generally, it has been revealed that about 67.4% of the respondents in the study area have confirmed the capacity to buy beekeeping inputs. Specific to each of the districts, 68.89%, 64.44% and 82.22% of the respondents from Mecha, Dangila and Guangua, respectively could access the basic beekeeping inputs through their own purchasing power (buying) (Table 11). However, 80%, 77.8% and 82.2% of Mecha, Dangila and Guangua respondents respectively have explained that the cost of modern (frame) hives is expensive while 53.3% and 55.6% of the respondents from Dangila and Guangua respectively said the price of top-bar hives, though they could be made from locally available materials, is also expensive. Whereas, 44.4% of Mecha respondents explained that the price of top-bar hives is cheap (Table 11).

Table 10: Sources of beekeeping equipment and accessories used by respondent beekeepers in the study areas

Sources of beekeeping inputs	Frequency	Percentage
Farmer's cooperative	3	2.40
Own	49	36.07
Retailer	13	9.96
BOA (livestock agency)	1	0.57
Research center	5	3.97
OXFAM	63	47.04
Total	135	100.00

Table 11: Buying practices and price of beehives

Response	Districts					
	Mecha		Dangila		Guangua	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Do you buy improved beehives and accessories?						
Yes	31	68.89	29	64.44	37	82.22
No	14	31.11	16	35.56	8	17.78
Status of frame hive price						
Expensive	36	80.00	35	77.78	37	82.22
Fairly expensive	7	15.56	9	20.00	4	8.89
Cheap	2	4.44	0	0.00	0	0.00
I do not know	0	0.00	1	2.22	4	8.89
Status of top-bar hive price						
Expensive	13	28.89	24	53.33	25	55.56
Fairly expensive	9	20.00	19	42.22	14	31.11
Cheap	20	44.44	0	0.00	2	4.44
I do not know	3	6.67	2	4.44	4	8.89

"At this point, it is very important to explain the optimistic nature of a key informant addressed in one of the districts studied for the price and their capacities to buy some basic beekeeping inputs by themselves, the key informant was determined to buy the basic beekeeping inputs depending on the price set and accessibilities of the inputs in the area. The key informant has also explained confidently that beekeepers could buy the beekeeping inputs, if they could be accessed in the nearby destinations as they have been trying to buy inputs from Bahir Dar which is far from their area. This key informant has also noted that the current price of some basic beekeeping inputs (though complained) could be covered by 2-3kgs of harvested honey".

About 75.6%, 55.5% and 62.2% of respondents women from Mecha, Dangila and Guangua, respectively, have confirmed that there will not be a market problem upon the establishment of a beekeeping input-producing enterprise in their area (Table 12). On the other hand, about 40% and 37.8% of the respondents from Dangila and Guangua, respectively, have confirmed that the demand higher for the beekeeping inputs depends on the availability and price of the inputs to be set. This further explains that the establishment of a beekeeping input producing enterprise should understand the status of the beekeeping farmers in the respective districts before deciding the prices. Proper and stepwise situation analysis before the establishment of the

beekeeping inputs production enterprise is an immense important prerequisite.

It is widely recognized that beekeepers in the study areas and across the country are not realizing the full benefits of the beekeeping sector, especially when compared to its potential (MoA, 2012). This has been complained through various local and regional reasons. Among these possible reasons could be ignorance or lack of knowledge, skill and motivation of beekeepers and professionals in diversification of the hive products.

As shown in Table 13, the majority of the beekeepers are interested in have beekeeping inputs so as to diversify bee product practices. If the market is good at sale different bee products, the majority of the beekeepers are also interested in buying bee product diversification accessories (Table 13). The beekeepers are also interested in getting training on the production of beekeeping diversification inputs locally. In order to get access to the beehive and accessories, the beekeepers will also use different strategies (Table 14).

Table 12: Perception of the respondents on the demand for beekeeping input producing enterprise

Response	Districts					
	Mecha		Dangila		Guangua	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
There is market demand for the products	34	75.56	25	55.56	28	62.22
Demand depends on the price of the products	8	17.78	18	40.00	17	37.78
No demand	3	6.67	2	4.44	0	0.00
Total	45	100.00	45	100.00	45	100.00

Table 13: The need for product diversification using beekeeping inputs

Response	Districts					
	Mecha		Dangila		Guangua	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Are you interested to have beekeeping inputs for diversifying your products?						
Yes	42	93.33	30	66.67	27	60.00
No	3	6.67	13	28.89	16	35.56
I don't know	0	0.00	2	4.44	2	4.44
Can you buy bee product diversification accessories?						
Yes	40	95.24	29	70.73	32	68.09
No	2	4.76	12	29.27	15	31.91

Table 14: Responses of respondents about their strategies to access beehive and accessories

Strategies	Frequency	Percentage
Use of self-modified inputs	32	24.1
Buying inputs wherever available	28	21.1
Doing nothing	13	9.8
Asking OXFAM`s support	20	15.1
Use of self-modified inputs and buying inputs wherever available	8	6.0
Use of self-modified inputs and doing nothing	29	21.8
Use of self-modified inputs and Asking OXFAM`s support	3	2.3
Total	133	100.0

3.4.2. Honeybee colony multiplication

In the study area, there are no organized efforts to undertake colony multiplication and supply to beekeepers. The survey results showed that the majority of the beekeepers in the three districts didn't practice colony multiplication (Table 15). The main reasons for not practicing colony multiplication are among others lack of knowledge and skill. Increasing the colony number and colony sale were the reason for practicing colony multiplication. Honeybee colony marketing is a common practice in the study area as indicated by the participants of KII and FDG. Proper and skill-based training is therefore necessary for beekeepers to engage more in colony multiplication so that beekeepers can earn extra income by selling honeybee colonies.

Table 15: Respondent`s honeybee colony multiplication practices

Response	Districts					
	Mecha		Dangila		Guangua	
	Freq.	%	Freq.	%	Freq.	%
Do you practice colony multiplication?						
Yes	14	31.11	10	22.22	12	26.67
No	31	68.89	35	77.78	33	73.33
Why you practiced colony multiplication?						
Sale of colony	13	28.89	10	22.22	5	11.11
Increase colony number	24	53.33	21	46.67	18	40.00
Both	8	17.78	14	31.11	22	48.89
Reasons for not practicing colony multiplication						
Lack of awareness	8	17.78	11	24.44	10	22.22
Lack of knowledge and skill	32	71.11	26	57.78	29	64.44
Lack of inputs	0	0.00	6	13.33	3	6.67
All mentioned above	5	11.11	2	4.44	3	6.67

3.4.3. Honeybee forage

Availability of abundant plants as pollen and nectar source is an important criteria for selecting a given area for beekeeping enterprise. In this regard, the majority of the respondents have bee-forage to support their own bees, environmental rehabilitation and sale seedlings (Table 16). Some of the respondents lack awareness in this regard. Nuru (2002) stated that unlike other livestock production systems beekeeping relies more on the suitability of ecology for reproduction and increase of the productivity.

Table 16: Bee forages plantation practices in the study area

Response	Districts					
	Mecha		Dangila		Guangua	
	Frequency	Percentage	Frequency	Percentage	Frequency.	Percentage
Do you grow bee forages?						
Yes	28	62.22	30	66.67	42	93.33
No	17	37.78	15	33.33	3	6.67
Why you grow bee forages?						
For selling of seedlings	3	6.67	2	4.44	5	11.11
To support own bees	23	51.11	26	57.78	22	48.89
To participate in environmental rehabilitation	4	8.89	5	11.11	2	4.44
All mentioned above	15	33.33	12	26.67	16	35.56
Reasons for not planting in growing bee forages						
Lack of awareness	23	51.11	31	68.89	33	73.33
Lack of knowledge and skill	4	8.89	1	2.22	1	2.22
Land shortage	3	6.67	2	4.44	1	2.22
Lack of inputs	4	8.89	7	15.56	9	20.00
All mentioned above	11	24.44	4	8.89	1	2.22

3.5. Challenges and opportunities of beekeeping input -producing enterprise

3.5.1. Challenges of beekeeping input-producing enterprise

Limited access to and high cost of beekeeping equipment and accessories: Beekeepers, livestock development agents and district beekeeping experts described that the supply of improved beekeeping equipment and other accessories are generally inaccessible for most beekeepers. They explained the practices at the district level, nowadays to some beekeeping equipment; the government is encouraging to organize jobless youth in towns into small and micro enterprises to get involved in the production of beehives (top-bars and movable frame hives). However, only a few enterprises are engaged in the business despite many incentives made by the government side. Protective clothes, casting mold, honey extractors, honey pressers and other tools are only found in big markets like Addis Ababa and Bahir Dar from importing companies. This makes the supply of this equipment inaccessible to the general beekeeping communities situated in rural areas. As a matter of fact, most of the supply of this equipment is done through government agriculture extension offices and some NGOs working in the development of the subsector. The high cost is also the major problem for most beekeepers, but for the poor households it is almost impossible without the support of the government and/or NGOs.

A women beekeeper explained the cost of modern hive:

> *"We are very interested to expand the modern beekeeping production. However, the modern hives are too expensive which is amounted 2000 Ethiopian birr. Most beekeepers cannot afford to buy modern hive and accessories as they have income problem"*

Similarly, a beekeeping expert describes the cost of modern hive:

> *"The cost of modern hives is expensive. The beekeeping cooperative sells modern hives with 2000 birr which is unaffordable for the farmers. If the farmers get low-cost modern hives, they would have not any problem aggressively engaging in modern beekeeping".*

Previous studies also showed that many beekeepers expressed the high cost of beekeeping equipment and accessories as the main problem for the adoption of movable-frame hive systems (Abebe *et al*., 2008; Girma *et al*., 2008; Yehuala *et al*. 2013; Yemane and Taye, 2013). Beekeeping equipment and accessories such as casting mold, honey extractors and movable-frame hives getting expensive from year to year, which puts an undesirable imprint on the entrepreneurial spirit of newcomers as well as of those who want to expand their business.

Poor quality of modern hive: Beekeepers currently highly complain about the poor qualities of the distributed modern hives. Similarly, livestock development agents, district beekeeping experts, and project facilitators also share the beekeepers' concern about the quality of modern hives.

Lack of knowledge on the quality of hives: A beekeeping input- producing enterprise owner described the lack of knowledge of beekeepers for quality hives as:

> *"I have produced top-bar and modern hives for local beekeepers. However, the local beekeepers do not know the quality of hives and they just only consider the selling price. I do not want to produce hives from Cordia africana and Juniperus procera rather I produce hives by using Australian Timber just for the quality purpose. When the beekeepers find my product as something more expensive than the others, they decline to buy my product without recognizing the quality of the hives".*

Lack of appropriate raw materials for the hive construction: Compared to traditional and transitional hives, modern hive construction requires good quality timber, which is expensive. The availability of good local materials or the high price of imported timber is a challenge for the construction of modern hives. An input-producing enterprise owner states the issues with the construction of a quality modern hive as follow

> *"I had produced hives by making contractual agreements with projects working on beekeeping development. Based on the specifications stated in the contractual agreement, I produced 150 hives within a year period. I used the so-called 'Austrian Timber' to produce the hives. This type of timber is imported from abroad. As you know, there is a price fluctuation in imported goods in Ethiopia and this scenario has substantially affected my business activities. The locally accessible raw materials like timber made from Cordia africana (wanza) and Juniperus procera (tid) are not that much good for preparing hives. Cordia africana by its characteristics bends during wet times whereas Juniperus procera is crackdown after some time. However, the Australian Timber has no such limitations*".

Lack of access to credit: Beekeepers, livestock development agents and district experts reported that the Amhara Credit and Saving Institution (ACSI) have not been providing adequate financial support for beekeeping businesses. Most of the loan has been used for purchasing movable-frame hives and accessories. In the past 5-6 years, Oxfam has given financial services for beekeeping business. Livestock development agents stated the access to credit for beekeeping business as:

> *"The credit associations have not flourished in our kebele though there is a high demand for credit among beekeepers. Amhara Credit and Saving Association is the only credit association. This cooperative gives a precondition for beekeepers to first save money for six months and then they will get credit service".*

Similarly, an input-producing enterprise highlighted the poor financial capacities of input-producing enterprises, which contributed for low level of beekeeping technology adoption:

> *"The input producing enterprises do not have adequate financial capacity to produce hives. In most cases, they produce hives when the customers give orders. The customers are also required to pay some amount of money ahead of time for buying raw materials. On the other hand beekeepers need ready-made hives to buy on the spot, which is not possible due to the financial constraints of the producers"*

Regarding to access to credit, Tegegne *et al*., (2010) reported that publicly owned Amhara Credit and

Saving Institutions and NGOs affiliated micro-finance institutions are providing financial services for livestock beekeeping investment.

Lack of competent beekeeping unions and cooperatives District beekeeping experts, livestock development agents and a project facilitator realized that Zeneba Union and its beekeeping cooperatives such as Andenet, Agunta, and Meserete Hiwot are not successful in terms of creating international market channels and doing other beekeeping -related activities though they got huge financial support from Oxfam. The failure of Zenebaba union is associated with management problem. The very characteristics of associations are vulnerable for misconduct as the government bodies have not legal right to monitor and follow-up of associations including beekeeping associations.

3.5.2. Opportunities of beekeeping input-producing enterprise

Market demand is the most important criteria that determine the visibility of an enterprise. The different associated factors analysis has been declared that beekeeping inputs do have high market demand supported by 97.7%, 81.8% and 59.6% of Mecha, Dangila and Guangua district respondents, respectively (Table 17). This further indicated that though depends on the types of beekeeping inputs to be produced and the type of raw materials used, the establishment of a beekeeping input enterprise in these districts or at the nearby destination could guarantee the sustainability of the enterprise.

Table 17: Beekeepers' perception on opportunities in establishing beekeeping inputs producing enterprises

Variables			Districts			Overall
			Mecha	Dangila	Guangua	
High market demand for inputs	Yes	Freq.	42	36	28	106
		%	97.7	81.8	59.6	79.1
	No	Freq.	1	8	19	28
		%	2.3	18.2	40.4	20.9
Increasing number of beekeepers	Yes	Freq.	19	37	23	79
		%	44.2	82.2	48.9	58.5
	No	Freq.	24	8	24	56
		%	55.8	17.8	51.1	41.5
Availability of raw materials for producing beekeeping inputs	Yes	Freq.	21	29	21	71
		%	48.8	65.9	44.7	53.0
	No	Freq.	22	15	26	63
		%	51.2	34.1	55.3	47.0
Access to technology	Yes	Freq.	18	32	20	70
		%	42.9	72.7	42.6	52.6
	No	Freq.	24	12	27	63
		%	57.1	27.3	57.4	47.4
Access to credit service	Yes	Freq.	41	35	29	105
		%	95.3	79.5	61.7	78.4
	No	Freq.	2	9	18	29
		%	4.7	20.5	38.3	21.6
Access to technical support from NGOs	Yes	Freq.	36	24	15	75
		%	83.7	54.5	31.9	56.0
	No	Freq.	7	20	32	59
		%	16.3	45.5	68.1	44.0
Government support is encouraging	Yes	Freq.	19	31	26	76
		%	45.2	72.1	55.3%	57.6
	No	Freq.	23	12	21	56
		%	54.8	27.9	44.7	42.4

Many respondents indicated that the growing number of beekeepers, availability of raw materials, access to technology and credit, support from NGOs, and high level of government attention are key factors driving the high market demand for beekeeping inputs, as these elements are essential for establishing beekeeping input production enterprises.

In Ethiopia, beekeeping is recognized as a very important sector in the recent government programs for development, poverty alleviation and conservation and sustainable use of natural resources (Tadesse and Phillips, 2007). The national goal is to enhance the production and marketing of honey, beeswax and other honeybee products and the government has been encouraging investors, exporters, producers, raw material suppliers and processors. According to the report of SNV (2009) about 10% of the honey produced in the country is consumed by beekeeping households. Domestic honey consumption is increasing due to increased honey demand for *"tej"* and *"birz"*, traditional drinks in Ethiopia, (Assefa, 2011). The export market of honey also increased from time to time (Assefa, 2011; EEPA, 2012). Beeswax is another valuable honeybee product and has local demand for making candles and foundation sheets for movable-frame hives and it is also one of the exportable agricultural products of the country (Legesse, 2014).

The presence of local wood enterprises in the study areas can be seen as opportunity for beekeeping input-producing enterprises. These enterprises produce timbers, which are important inputs for beekeeping enterprises.

3.6. Strategies for the establishment of input producing enterprises and innovative ways of input supply system

Based on the information collected on the potential and richness of the study areas in different bee forage species, honey bee colonies and favourable beekeeping environments which could maximize honey production, beekeeping in the areas has been identified as a useful income -generating option in the study areas. However, the traditional way of colony management including honey harvesting has resulted in low yield and poor quality which has mostly discouraged both sides. This traditional practice also is blamed for brood and adult bee killings leading to a decline both in colony strength and number. Thus, a need for practicing improved techniques and use of improved beekeeping equipment (inputs) for improved quality products' production and colony strength benefits and minimizes brood and adult bee deaths shall get an important attention. Moreover, beekeeping development will not only help farmers earn cash income through honey and other bee products, but also by providing ecosystem services (pollination) for green agriculture.

Development of rural enterprises which are working and strengthening the sector through self-employment and rural-urban migration control, therefore, will further support the ongoing poverty reduction efforts of the government. For this case, a continuous visit to sites assessing the feasibility of promoting beekeeping inputs producing enterprises as a source of livelihood diversification in these areas is a preliminary strategy to understand and to be practiced. Though this study has revealed that beekeeping is an important agricultural practice using various inputs among sampled respondents (households) in all of the study areas, it has been significantly explained that price, source, access on both sides and quality of beekeeping inputs on all study districts is not pleasant or encouraging. Moreover, the unavailability of strong linkage between government, beekeepers and input producers or providers has magnified the need to work on this issue and suggest some basic strategies for the establishment and functioning of potential small or medium- scale input producers and/or providers in each of the study districts.

To harness this potential the government (both regional and local) through its various efforts to capacitate local enterprises need also to support rural beekeeping communities through the development of a viable beekeeping input producing enterprise as a source of income through input production, increase

accessibility of beekeeping inputs to rural women who are more appropriate beekeeping practitioners for improved production and diversification. Moreover, building the capacities of partners (stakeholders), local youth and farmers in using improved beekeeping practices and other inputs needs to be also important step to follow for sustainability issues.

Key interventions suggested for developing beekeeping input producing enterprises and innovative ways of input supply system:

- As beekeeping could be a potential tool, improved and integrated approaches and knowledge shares which could promote gender roles in beekeeping inputs development and its inclusiveness shall be considered as a significant activity needing due emphasis
- As a strategy, start with promoting the use of beekeeping and the importance of beekeeping inputs in creating jobs for the ones in need and improving the quality of hive products for maximized income earnings to support efforts towards ensuring resilient livelihoods among our rural women.
- Identification of potential enterprising candidates or groups (including women) and concerned partners and staffs in each of the working districts with keen interest in working on beekeeping inputs and with beekeepers shall take the footstep action
- Building capacities of target entrepreneurs through training and experience sharing from successful or active enterprises (like hive-making workshops, input selling shops) shall be considered an important activity for positive energy in the business
- Supporting enterprise development and business management (i.e. training in product development, value addition and business plan development) and linking enterprises with public and private institutions for sustainable demand-driven marketing shall take an important consideration in the establishment process to encourage and capacitate entrepreneurs.
- The establishment of a technical team under the regional livestock development and promotion agency in collaboration with relevant stakeholders at all levels to accomplish the following tasks is considered an important step in the sustainability of established enterprises.
    - Provide appropriate theoretical and practical training including provision of input specifications to implementers (including the ones who are really making the inputs not only for enterprise managers) and follow up on the efficiencies of trained entrepreneurs
    - Identify, evaluate and specify locally available materials which could be used as beekeeping input production and their maximum and wise use and recommend accordingly.
    - Collect feedback information from end users (beekeepers both women and men) for possible modifications and correcting technical issues based on biological requirements of the honey bees.
    - Supervise the implementation of the technical issues at the farmer's and input producer's gate
    - Undertake the monitoring and evaluation of enterprises including the quality of the service delivered to the beekeeping farmers and quality of technical support from the technical teams (this could be done by higher officials or assigned professionals or consultants).
- The establishment of beekeeping input producing enterprises needs to be backed up by the implementation of conducive decrees and proclamations on the importation of tax-free inputs which are used to produce beekeeping inputs (like timbers, foundation sheet producing equipment, wax extractors, woodwork machineries, etc.) through established unions, cooperatives or organized associations

- Encouragement of quality and cost-effective input (box hives, top-bars, beeswax, foundation sheets, extracted honey, beekeeping protections, etc.) producing or providing enterprises and vice versa shall be a day-to-day activity

- In order to create enabling and sustainable relationship among input producers and beekeeping farmers (with respective to women and youth groups), the need for establishing a confident teamwork approach and linkage among and within entrepreneurs who might be specializing in different beekeeping input provision and/or production is recommended and found to be very important strategy

- Strengthening the access to information, market, finance and technology

- Strong awareness creation among local beekeepers, consumers and traders on quality product marketing and the use of improved inputs will guarantee the future apiculture sector. However, here, it is very important to aware beekeepers to produce genuine products, and provided their products to their respective cooperatives or organized groups with the right to get the right price marks; main market actors (traders, retailers, collectors) to give the right price to the right produce and discourage adulteration; consumers need to trust beekeepers for their produce, buy products from known sources, disclose adulterated products; regulatory and marketing officers to control the market issues and illegal trades. This is the way to encourage more farmers to engage in beekeeping and sustain input producing entrepreneurs and the sustainability of our agriculture at large

- Encourage wider adoption of innovations and practices to lead beekeeping towards positive impacts for women in particular and beekeepers in general.

- Proper empowerment, training and involvement options have to be continuous important activities to increase women's engagement in beekeeping, improve the productivity of local colonies through improved colony management and proper beekeeping practices, and motivate rural farmers to integrate their agricultural activities with beekeeping for better and sustainable green agricultural productivity. This way, household income and livelihood food security efforts could improve.

- Encourage gender mainstreaming in beekeeping value chain development through the involvement of everyone in the society, regardless of gender, caste, or ethnicity with which adequate participation could be strengthened through training, exposure visits and other capacity- building activities at the time and place most convenient.

It is advisable to follow, evaluate and implement the strategies for proper functionality and establishment of successful beekeeping input-producing enterprises in and around the study districts with strong links with sustainable marketing wing in and around the Amhara region. Strategies are of course subjected to revision and shall fit to local conditions depending on prevailing and changing situations. In this case, it is very important to organize a round table discussion on the validation and assortment of draft strategies ultimately to support women beekeepers at every corner.

4. Conclusion

The study revealed that women gathering together to share their ideas, get training, work with bees, etc. are indicative of improvements which have come after Oxfam's intervention. This generally could be a positive energy for further expansion of the sector if beekeepers are organized and continue discussing the issues. However, lack of access, high cost and sometimes qualities of inputs have been identified as challenges that women beekeepers are facing in areas which strongly need active roles and responses for the betterment of rural women. Ignorance or lack of knowledge and skill including the motivation of beekeepers and professionals was also demonstrated problem. Encouraging market demand, increasing the number of beekeepers, availability of raw materials used in input production, and important support from Oxfam were identified as potential opportunities in

the study areas. Therefore, further improvements in the sector could be better through awareness creation, training, engagement of stakeholders and finding mechanisms to harness and minimize the cost of beekeeping input production and increase their accessibilities among beekeepers, encouragement and inclusiveness of gender mainstreaming in the beekeeping value chain development agendas starting from planning, implementation to the evaluation phases shall receive due emphasis.

Acknowledgements
The authors acknowledge OXFAM - GB for funding this work.

Data availability statement
Data will be made available on request.

Conflicts of interest
The authors declared that there is no conflict of interest.

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