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Value Chain Analysis of Honeybee: The Case of Kilte-Awlaelo and Degua-Temben Districts of Tigray, Ethiopia

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Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

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ABSTRACT

This study was conducted to analysis the objectives of identifying actors in the value chain and assessing their linkages and roles of the actors. The primary data were collected from randomly sampled 120 producers,10 honey retailers,5 honey wholesalers 5 consumers, 5 honey transporters,5 processers ,10 respondents from café and hotels including collectors/assemblers, cooperatives and brokers. The major honey value chain actors in the study districts were found Input suppliers, agriculture office and rural Development, Dedebit saving and credit institution, Mekelle agricultural research center, honey producers, wholesalers, retailers, collectors, processors, and consumers. Beekeepers use six alternative marketing channels to sell their honey until the product reaches to the final consumer. Beekeeper market participants of sample respondents were supplied 7535 kg of honey to the market.

Keywords: Value chain; honeybee; honey value chain; beekeepers marketing; beekeeping.

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1. INTRODUCTION

"Ethiopia is the leading honey producer in Africa and one of the ten largest producers in the world, and among the four top largest bees wax producing countries" [1]. "Owing to its varied ecological and climatic conditions, Ethiopia is home of the most diverse flora and fauna in Africa. Its forests and woodlands contain diverse plant species that provide surplus nectar and pollen to foraging bees" [2,3,4,5].

"Ethiopia produces about 24000 tons of crude honey per year, thus shares 24% of Africa and 2% of world's honey production. This makes the country 1st in Africa and 10th in the world. Currently, more than 7000 species of flowering plants are estimated to be found in the country, of which most of them are honeybee plants" [2,3]. "Ethiopia, which has the potential to produce 500,000 tons of honey and 50,000 tons of beeswax per annum, has only exported 10,058.8 tons of honey and wax and earned 26.7 million USD over the past five years" [1,6,7].

"Although the long tradition of beekeeping in Ethiopia, having the highest bee density and being the leading honey producer as well as one of the largest beeswax exporting countries in Africa, the share of the sub-sector in the GDP has never been proportionate with the huge numbers of honeybee colonies and the country's potentiality for beekeeping" [8]. "Productivity is still low, leading to low utilization of hive products domestically and relatively low export earnings. Thus, the beekeepers in particular and the country in general is not benefiting from beekeeping production" [9,10,11].

"Similarly, Tigray beekeeping has a long-standing tradition, dating back to ancient times during the kingdom of Abyssinia" [12]. "It currently has strong growing end markets making it viable enterprise for women and landless youth" [13]. "The number of bee colonies in Tigray was estimated to be 206,040 (63 % and 37% of which are traditional and framed bee hive, respectively" [14]. According to [15] one season honey production was 25,454 quintal and 2008/09 annual production was 31,000 quintals.

"Although the districts have potential of beekeeping activities which is about 26411 and 8571 modern and traditional bee hives found at Kilteawlaelo similarly 6697 modern beehive and 7345 traditional beehives also at Deguatemben district (Office of Agriculture and Rural Development of Kilteawlaelo and Deguatemben districts). Thus, to the level of my knowledge and assessment, there is no complete and reliable information on honey value chain. The tendency to address key value chain actors, services providers, and challenges along honey value chain in a holistic manner is not well understood" [13].

"Under such circumstances, there was an urgent need to address this knowledge and information gaps on honey value chain that focused on production problems, marketing problems, upgrading strategy, value chain governance and roles and responsibilities of actors to support the undergoing developments efforts. Value chain analysis has a long tradition in industrial production, organizational and global export commodities but its application in international development and agriculture has gained popularity only in the last decade (Rich et al., 2008). In Ethiopia, value chain analysis was mostly conducted for export commodities such as coffee, hides and skin and sesame. So, this finding on honey value chain is expected to help in order to fill the gap of knowledge in the field Therefore, this study was had paramount importance in analyzing honey value chains and its socio-economic contribution to value chain actors in Kelte welelo and Degua temben districts of Tigary region and contribute to the better understanding of honey value chain" [15].

General Objective: To analyze the Value chain of honeybee in the study area.

Specific Objective: To identify major honey value chain actors, functions and their linkages in the study area

2. METHEDOLOGY

2.1 Study Area

Kilte Awlaelo and Degua temben districts found in Eastern Zone of Tigray regional state, Ethiopia. The districts are selected based on the potential of beekeeping honey production, and accessibility.

Kilte Awlaelo District: It is geographically located between 13°44'59.99" N 39°29'59.99" E located in the eastern part of Tigray at a distance of 45 km from Mekelle, It borders with Hawzien and S/ Tsadaemba in the North, Atsbi Womberta in the East, Douga Tembien in the West and Enderta in the South. The district currently

encompasses a total of 15 kebeles. The district is classified as mid-highland. The altitude of the district ranges from 1980 to 2500 m a.s.l. The average daily air temperature ranges from 15^{o}C and 30^{o}C. The mean annual rainfall is about 558 mm. And also characterized with livestock population of 64033 Cattle, 94842 sheep and goat, 62610 chickens and 23815 bee hive colony, mixed crop livestock type of farming system is practiced and based on the [16] population projection for the year 2014, it was estimated to have a total population of 109,583 of whom 53,061 are men and 56,522 are women; 6,824 are urban inhabitants.

Degua-tembien District: is geographically located between 13°29'59.99" N 39°14'60.00" Ethe study area is one of the honey potential districts found in south eastern zone of Tigray region. It is located at 45km west of Mekelle city and bounded by Kileawlalo wereda from north, Seharti samre in the south, mekelle city in the east and Kola tembien in the west. The woreda is divided in to 23 rural and 1 urbal administrative kebelles. The weather condition of the area is characterized by 95% Degua, 5% weyna degua and kola. Temperature of the area ranges from 19-23 ^{o}c [17].

In Degua-temben wereda, there are 23 peasant associations (PAs), 23 Farmers Training Centers (FTCs), 23 cooperative associations and one union (Hagereselam Farmers' Cooperative Union). The average land holding in the wereda is 0.64 ha per household. The wereda has an estimated total population of 113,595 of which 56,955 (50.14%) are male and56, 640 (49.86%) are female. From the total 27,183 rural household heads, male headed households account for 72.55%, while female headed households account for about 27.45% [18].

2.2 Sampling Method

Multi-stage random sampling technique was implemented to select representative honey producers of the two districts and kebeles of sample households. In the **first stage**, in consultation with study districts of agricultural experts and development agents, two kebelles from Hagereselam and two kebelles from Wukiro Woredas purposively selected based on the level of honey production potential and distance of the kebelles to the woreda market. Namely selected kebelles are Aynimbirkekin and Debrenazirate from Deguatemben Woreda, Adidekisandid and Mesanu from kilteawlaelo Woreda.

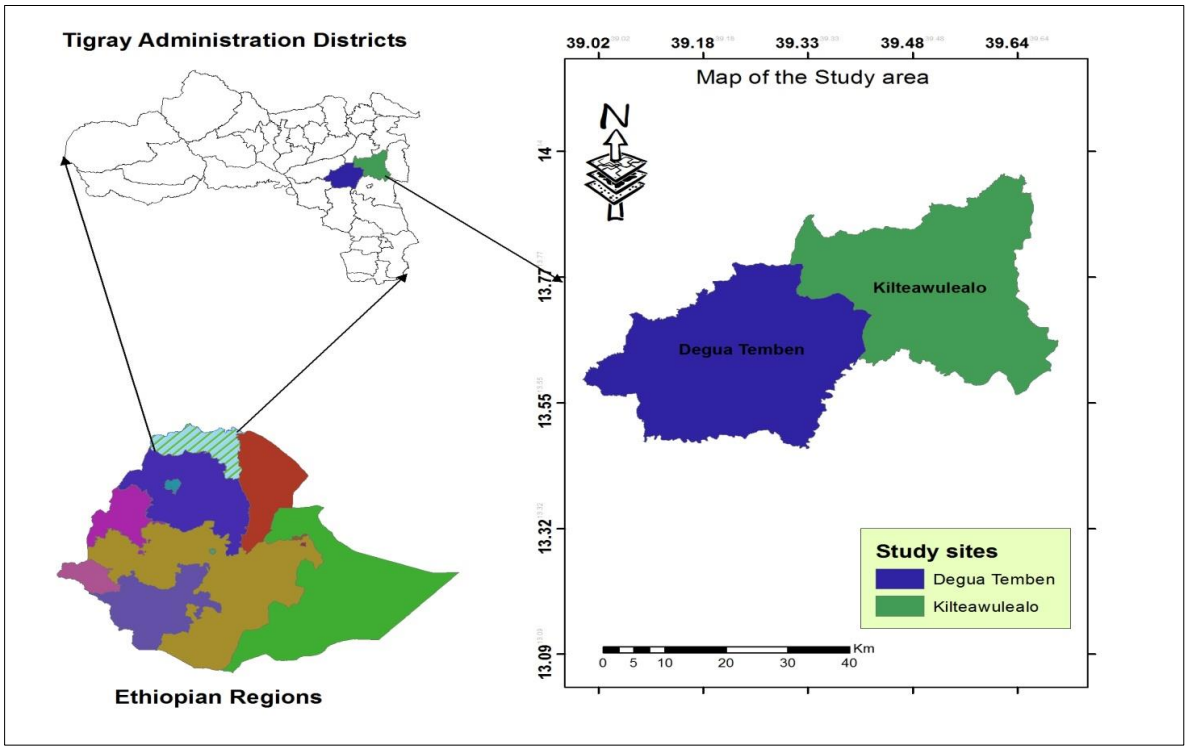

Fig. 1. Geographical location of the study area

Table 1. Name of the study kebeles and sample size

S/N	District	Kebelle	Number of beekeepers	Number of Sample households
	Degua temben	Aynimbirkekin	765	29
		Debre Nazirate	440	17
	Kilte Awlaelo	Tahitayaidekisandid	974	37
		Mesanu	990	37
Total			**3169**	**120**

Source: Own computation
NB. The sample size is calculated with 9% level of precision

In the **second stage** using [19] the sample size determination formula 120 sample sizes for honey producing farmers were determined.

$$n = \frac{\mathrm{N}}{1 + \mathrm{N(e)2}}$$

Where

- **n** is the sample size,
- N is the population size
- **e** is the level of precision

e = 0.09 precision

- $n = \frac{3169}{1+3169(0.09)2}$ = 120

And proportional sampling technique was utilized to determine the sample size of honey producing household's form each study kebelles, using the household list of the sampled kebelles, and total of 120 sample bee keeper farmers were selected randomly from the selected rural Kebelles.

Moreover, 40 honey value chain actors were also included as part of this study. These includes:10 honey retailers,5 honey wholesalers 5 consumers, 5 Transporters,5 processers ,10 respondents from cafe, and hotels including collectors/assemblers, cooperatives and brokers. Both formal and informal methods of data collection methods were used through structured questionnaire and focus group discussion methods.

2.3 Data Collection

The study used primary and secondary data. Primary data were collected using formal surveys. The formal survey was undertaken through formal interviews with randomly selected farmers using a pre-semi-structured questionnaire survey used key informants' interview and visual observations. Specific checklists were used to guide key informants' interviews. The secondary data were collected from Central Authority (CSA), Office of Agriculture and Rural Development (OoARD), Tigray Agricultural Marketing Promotion Agency (TAMPA), Tigray Agricultural research institution (TARI), Journals and websites were also reviewed.

2.4 Data Analysis

"Different statistical analysis methods were employed for this study depending on the nature of the data since descriptive, mapping the value chain to understand the characteristics of the chain actors and the relationships among them, including the study of all actors in the chain, of the flow of honey through the chain, the destination and volumes of domestic and foreign sales. This information can be obtained by conducting surveys and interviews as well as by collecting secondary data from various sources" [19]. Accordingly, SPSS (version 20) statistical software was used for the descriptive part of the data to analyze mean, frequency, percentages and ranking index also used to rank the major honey buyers of the districts.

3. RESULTS AND DISCUSSION

3.1 Demographic and Socio-Economic Characteristics of Sample House Holds

The demographic and socioeconomic characteristics of the sample respondents are indicated in Tables 2 and 3. The total sample size of respondents handled during the survey was 120 which is 73 at kilteawlaelo and 47 at Deguatemben kebelles respectively. From the total sample respondents 93.33% were male-headed household and 6.67% were female-headed. With regards to the educational status of sample respondents, 70.83% of the total sample households were literate and 29.17 of the sample respondents were illiterate. Additionally, the respondent's marital status was 2.5% 90%, 3.3% and 4.17% were single, married, divorced and widows respectively.

Table 2. Demographic and socioeconomic characteristics of sample (categorical variables)

Variables Items		Total Sample (n=120)	
		n	%
Sex	Male	112	93.33
	Female	8	6.67
Education	Literate	85	70.83
	Illiterate	35	29.17
Martial status	Single	3	2.5
	Married	108	90
	Divorce	4	3.33
	Widowed	5	4.17

N is number of respondents
Source: own survey data 2020

Table 3. Demographic and socioeconomic characteristics of sample households (continuous variables)

Variable	Kilteawlaelo (N 73)				Deguatemben N(47)			
	Min	Max	Mean	SD	Min	Max	Mean	SD
Age	25.00	85.00	50.04	12.27	25	68.0	48.13	11.27
Family Size	1.00	6.32	5.84	2.41	2	11	6.32	1.84
Land size	0.13	2	0.72	0.40	2	.50	0.99	0.42
Beekeeping experience	2	30	10.06	0.85	1	40	11.42	0.80

- *Source: own surveydata,2020 SD standard deviations*

The average age of sampled respondents was 50.04 years at Kilteawlaelo district and 48.13years at Deguatemben district. The average family size of the total sample respondents was found to be 5.84persons at Kilteawlaelo and 6.32 persons at Deguatemben. The average Size of landholding per household of the respondents was 0.72 hectare at Kilteawlaelo and 0.99 hectar at Deguatemben districts. The survey result with respect to beekeeping experience of respondents indicates that an average year of experience related to beekeeping was 10.06 years at Kilteawlaelo and 11.42 years at Deguatemben districts.

3.1.1 Honey value chain actors

Honey Value Chain Actors: In the study area, Honey value chain actors are those individuals who exchange money as well as honey product, which generally increases in value with each market transaction of honey. The primary actors in the honey value chain in the study area were input suppliers, farmers, collectors, retailers, wholesalers, cooperatives, local drink processors (‘‘Tej’’-makers) café, snack and individual consumers this results with same difference like consistent with [20,21]. Beekeepers, office of agriculture and rural development (OoARD), NGO (Relief Society of Tigray) Mekelle agricultural research center (MARC) cooperatives and microfinance were the main actors and institutions involved in honey production and input supply activities. Collectors are engaged in buying honey from village markets and sell the largest portion of crude red honey to local processors (“Tej”-makers) and wholesalers. Retailers buy honey from beekeepers and sell to local drink processors (“Tej” makers), wholesalers, Snack, cafe, grocery and consumers. Wholesalers buy honey mainly from collectors, retailers, cooperatives and sell to industrial processors, groceries, hotels and individual consumers.

3.1.2 Honey value chain service providers

“Honey value chain of the study area is supported by different actors. Value chain supporters provide support services and represent the common interests of the value chain operators. They remain outsiders to the regular business process and restrict themselves to temporarily facilitating a chain upgrading strategy. Typical facilitation tasks include creating awareness, facilitating joint strategy building and action, and the coordination of support activities (like training, credit, input supply, etc) and facilitating market” [19]. The main supporters of the honey value chain in the study area are District’s Office of Agricultural, Cooperatives /Union, Mekelle Agricultural research Center (MARC), REST, Dedebit saving and credit Institution (DSCI).

Value chain governance: Value chain actors govern the flow of honey and level of prices. In effect, they govern the value chain and most other chain actors contribute to the rules set in the marketing process. In most cases, the business relations between the various operational actors are of free market exchange. In the study area, the general pattern in honey market is for all actors: producer's traders, whole sales and consumers to buy and sell honey each time they go to the market. Producers do not have any known customer relationship with any of these buyers, and they sell their products to anyone. There is no formal supply arrangement between producers and even the most regular honey purchasers in the markets. This suggests that there is no vertical connection in the districts' honey value chain between producers and any buyers. This is mostly due to the production system's lack of market orientation, which prevents manufacturers from meeting key market players' demands for quality or demand. Consequently, there is a limited degree of knowledge and skill transfer from buyers to producers. In general, buyers drive the governance of the honey value chain.

3.1.3 Honey bee value chain Map

This value chain map shows the flow and amount of honey and services among the major actors from early supply of inputs and production up to consumption. The main value chain actors affecting the entire value chain are producers, collectors, cooperatives, wholesalers, retailers, processors and consumers and each actor with different value adding activities this result is similar with result [22,23]. These major actors are interconnected with six main channels in which honey flows to reach the final actors.

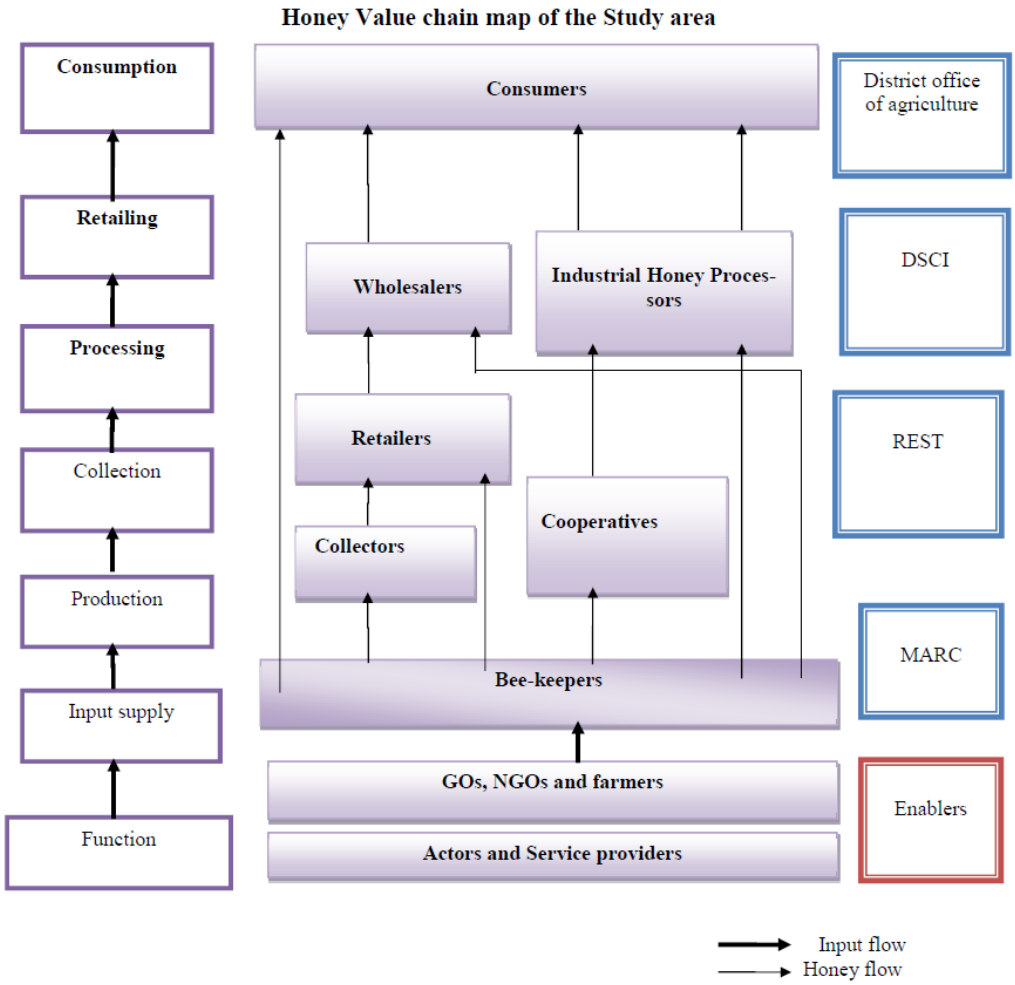

Fig. 2. Honey Value chain map of the study area
Source: Own sketch based on field survey, 2020 Honey flow

Table 4. Summery of honey chain Actors and their functions of the study areas

Functions	Actor	Role
Input supply	• Farmers • District Agriculture and Rural Development office, REST, cooperatives and TARI	• Traditional hive preparation • Provide bee colonies • Prepare modern hives and • provide training & technical advice. Market information
Production	• Beekeepers using subsistence methods and practices	• Provide supplementary feed • Attending, shelter preparation and cleaning • Forage plant planting • honeybee management
Harvesting and post-harvest handling	• Beekeepers	• Honey harvesting • Gathering price information • Handling and transporting to market places
Honey collection at local markets, district and regional towns	• Honey collector and marketing cooperatives	• •Collect honey from farmers at local markets • Checking quality, and sorting • Form market linkages with other markets
wholesalers in Mekelle(capital city)	• Honey collecting	• Honey collection • Store honey • Simple processing • Gathering market information
‘’Tej’’ processing	• ‘’Tej’’ processors	• Produce Tej and Berz (Local alcohol)
Honey processing and Export/domestic marketing	• Honey processing units Mekelle and Adigrat • Exporters	• Collect, package, grade and process honey. • Distribute the processed products to foreign buyers and local super markets

Source: own survey data, 2020

3.2 Honey Marketing Channels

“The channel that farmers normally target for their honey is the local market. The flow of honey from the production centers to the consumer end depends on the distance and market closeness, means of transport, availability and quality of infrastructures, the nature of the product, the need and purchasing power of consumers. Most farmers sell honey in markets within their district. Beekeepers of the study area have six main alternative channels identified for honey marketing. Few producers sell their product at farm gate especially for the farmer traders/collectors, cooperatives and processors. But the majority of the respondents supply their honey to retailers, wholesalers and Tej makers of the two districts (Hagereselam and Wukiro) markets” [24]. The main marketing channels identified from the point of production until the product reaches the final consumer through different channels were indicated Fig. 3:

The shortest channel was found directly producers to consumers that is the channel 1and the reason for the choice of this channel was most of the consumers were buy small quantity of honey at local markets. Market channel two refers to beekeepers who sell their honey to retailers; retailers sell out their purchase to consumers. Channel three beekeepers sell their honey directly to cooperatives, cooperative sell their honey to processors and processors sell to consumers. Channel four is the outlet through which bee keepers sell their honey to collectors and collectors sell to retailers and retailers sell to consumers.

From the household survey result, it was found that majority (40.52%) of the sampled bee keepers preferred to sell their honey directly to retailers. Moreover, it was also found that high proportion of sample households (26.3%) sold their honey through channel 1 that is directly to consumers.

3.2.1 Honey marketing

Honey marketing in the study area was characterized by direct to traders and individual consumers. Most of the beekeepers who participated in focus group discussion (FGD) in

each study'' Kebelle'' noted that they sell their honey produce in local market directly to retailers and individual consumers. Few also have said that some of their produce sold in their homestead by visiting urban occupants and'' kebelle'' level civil servants. The major buyers are local traders and collectors except the fourth ranked buyers (wholesalers) indicated in Table 5 which are participate in one ''kebelle'' at Deguatemben District.

According to the descriptive analysis result beekeepers largely sell their honey in their nearest local market, usually at a distance of 1 to 15km away from their residential areas, except 2.3% of farmers who live in Deguatemben district Debrenazirate kebelle were sell their honey to wholesalers at Mekelle market.97.7% of honey producer farmers from Deguatemben were sell their honey at their nearest market Hagereselam. But respondents from Kiltewlaelo 100 % of their honey were sold at their nearest market Wukiro city. Beekeepers sell the largest proportion of their honey during harvest at low price mainly to meet their demand for cash to cover their daily consumptions and to pay debts, taxes, and other social obligations. In addition, beehives and bee colonies were well marketed in Kilteawlaelo districts but not so in Degua temben. Honey producing farmers organized in cooperatives. In addition, individual honey producer farmers also said that they supply and sale honey to local union which is involved in honey production and marketing. Moreover, the collector and retailers in the district collect the honey from beekeepers and resell to other consumers, retailers and wholesaler in the region, Addis Ababa, Saudi Arabia and America. The different traders in the study areas stated that there are supplies of low-quality honey, which might arise from harvesting, storage and adulteration.

The major honey buyers in Kiltewlaelo were reported retailers while at Deguatemben study district consumers were reported the major payers.

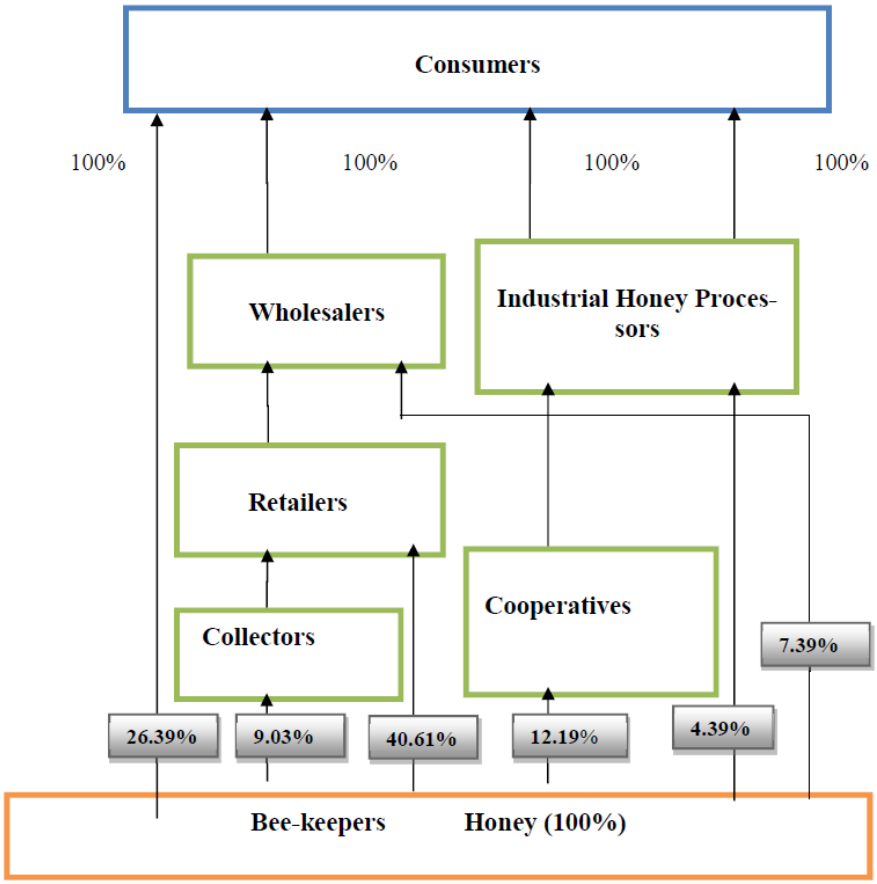

Fig. 3. Honey marketing channel
Source: Own sketch based on field survey, 2020

Table 5. Major buyers of the two the districts using ranking index

No.	Major Buyers	Kilteawlaelo		Deguae temben	
		Index	Rank	Index	Rank
1	Retailer	0.55208	1st	0.25252	2nd
2	Wholesaler	0	-	0.12121	4th
3	consumer	0.20833	2nd	0.27272	1st
4	processor	0.01041	5th	0.02020	7th
5	Cooperative	0.19791	3rd	0.07070	6th
6	Tejbrewery	0.03125	4th	0.08080	5th
7	Collector	0	-	0.1818	3rd

Source: Own survey data, 2020

4. CONCLUSIONS

Apiculture is a promising off-farm enterprise, which directly and indirectly contributes to smallholder's income in particular and nation's economy in general. According to the research area's honey value chain analysis, the primary participants in the chain are honey growers, collectors, retailers, wholesalers' cooperatives, and processors. Collectors buy honey from the district's kebele, particularly in Deguatemben, and resell it to industrial processors (kummel). Producers sell to retailers and certain wholesalers, who then semi-process, sort, grade, and deliver the goods to the districts' central markets. Consumers receive the honey in Tej or packaged form after processors do value-adding tasks like sorting, packaging, and filtering it.

The beekeepers supply their honey to six market channels according to their market choice decision. According to their decision more amount of produce was supplied to retailers. This is may be reflects that retailers provide with better share of value created. Major share of honey marketing goes in retailers (channel II) which are from producers to retailer's channel (40.52%). This is due to the preference of honey producers to sell their product to retailers so as to get better price for their product. Since this indicates that un functional marketing cooperatives and poor market organization and lack of any responsible honey collecting agent at reasonable price of the study area since producers enforce to sell their honey to retailers rather than directly to consumers. Hence, producers have poor bargaining power to sell their produce. Therefore, functionalizing the established cooperatives nearby beekeepers will reduce transportation and marketing cost and sells at better price.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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