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Market Behavior Analysis of Beekeeping Input and Outputs Marketing: Evidence from Wag-Lasta, Amhara region, Ethiopia

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Abstract
The study aimed to characterize the demand and supply patterns of beekeeping inputs and outputs, analyze the price volatility of these products, and generate actionable market information for farmer beekeepers, investors, entrepreneurs, and other market actors. Conducted as part of a national initiative, the study focused on four districts—Sekota, Dahina, Ziquala, and Lasta—representing diverse agro-ecologies in the highland, midland, and lowland areas. Samples of 139 households from nine Kebele were selected using random sampling for interviews. Analytical methods included descriptive statistics, consumer price indices to assess market price volatility and Structure, Conduct, and Performance analysis was employed to examine the honey market structure, revealing that district level traders dominate with a 67% market share. The market was characterized as perfect competition because of the price determined by the market itself and no entry barriers, there is significant competition among traders, producers. Eight distinct sales channels were identified. The findings indicate that beekeepers have sufficient market access, but production constraints limit their potential. The study emphasizes the need for establishing direct linkages between beekeepers and suppliers to improve access to modern inputs, enhancing honey processing at the farm level to boost quality and marketability, and encouraging investment in honey processing industries to add value and increase competitiveness. Promoting cooperatives also essential to improve market operations and ensure better pricing for producers. Strengthening organized market channels, enhancing communication between producers and traders, and integrating middlemen into the formal market are critical to empower beekeepers and ensure equitable market access.
Keywords: Market, Input, Output, Beekeeping, Channels, Price volatility
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1. Introduction

Apiculture is a critical sector in Ethiopia, providing food and income through beekeeping activities. It meets immediate needs for cash and sustenance, making it a valuable livelihood strategy. According to the 2018 CSA report, Ethiopia has approximately 6.52 million hives, with about 96.98% being traditional hives, while transitional and modern hives account for only 1.06% and 1.95%, respectively. In 2018, the country produced 66.22 million Kg of honey, predominantly from traditional hives, with per hive productivity estimated at 15 kg, 7 kg, and 10 kg for modern, transitional, and traditional hives, respectively (CSA, 2018).

Despite the sector's potential, the report by ILRI and MoA (2013) noted that only 10% of honey and beeswax are marketed, with other products like bee venom and propolis largely untapped. As honey gains value in both domestic and export markets increasingly, smallholders actively supply honey to meet rising consumer and market demands. In 2011, over 400 tons of honeys were exported, pushing domestic prices to near or above international levels (ILRI and MoA, 2013).

In the Amhara region, there are about 1.2 million beehives, including 1.1 million traditional hives, 5,986 transitional hives, and 32,273 modern hives, accounting for 17% of the nation's total hive population (CSA, 2018). Wag-Lasta, located in eastern Amhara, is characterized by limited agricultural resources, constraining crop and livestock production. However, its environmental diversity and dense bush lands make it ideal for beekeeping. Adebabay et al. (2008) highlighted that while the western Amhara region benefits from dense vegetation and abundant bee colonies, the eastern part, with its inaccessible lands, still holds significant potential for honey production.

Despite extensive research conducted on honey production practices, physicochemical properties, and general beekeeping techniques in Wag-Lasta (Tewodros *et al*., 2013; Alemu *et al*., 2015; Kalayu *et al*., 2017), there is a notable gap in understanding the marketing behaviour of honey in the region. This study aims to fill this gap through exploring the honey marketing dynamics in Wag-Lasta, offering critical insights to enhance the economic potential of beekeeping in the study area. Therefore, the study specifically aims to characterize the demand and supply patterns of beekeeping output markets and analyze the price volatility within these markets in the study areas.

2. Research Methodology

2.1 Description of Study Area

This study was conducted in the Wag-Lasta area of Amhara region, Ethiopia of four districts —Sekota, Dihana, Ziquala and Lasta districts. The Wag-Lasta rainfall is characterized as a unimodal rainfall pattern from late June to late August or early September. The mean annual rainfall in the study area ranges from 333 to 1,016 mm and minimum and maximum temperatures of 8°C and 21°C, respectively (Dereje and Tadesse, 2014).

2.2 Sampling Strategy

Four districts were selected to ensure the better representation of beekeeper households across different agro-ecologies (lowland, midland and highland) from the Wag-Lasta area. The sampling unit of the study was all beekeeper farmers in the selected districts and kebeles. A multi-stage sampling technique was employed to choose representative districts, kebeles, and respondents. First, the four districts were purposively selected based on their beekeeping production potential. In the second stage, nine kebeles were randomly selected from each district. Finally, the 139 beekeeper households were selected using systematic random sampling technique from beekeeper farmers. Additional data from actors like traders, experts, NGOs, input suppliers, and cooperatives were directly collected without sampling procedures due to their limited numbers.

2.3 Analytical Methods

Descriptive statistics, including mean, standard deviation, frequency, and cross-tabulation, were used to analyse the data. Consumer price indices were calculated for each district to understand price behaviour for beekeeping outputs. Structure-Conduct-Performance (SCP) model was used to assess market performance and value chain analysis (Ferguson, 1988).

Market performance was evaluated using marketing margin share, which measures the distribution of profits among actors along the value chain. The producer's share is a key indicator of market performance in agricultural marketing and it was calculated as the ratio of the producer price (farm gate price) to the retail (consumer) price, multiplied by 100.

$$\mathrm{PS} = \frac{\mathrm{PP}}{\mathrm{CP}} * 100 \text{ Or } \mathrm{PS} = 1 - \frac{\mathrm{GMM}}{\mathrm{CP}} \text{ ---------- (1)}$$

Where: PS = Producers' share, PP = Producers' (farm gate) price, CP = Consumer price (retail price), GMM = Gross marketing margin.

GMM is the total margin from retail price that goes to actors other than producers of the commodity. It is gross because it doesn't deduct operating costs of the actor. It can mathematically be depicted as:

$$\mathrm{GMM} = \frac{\mathrm{CP}-\mathrm{PP}}{\mathrm{CP}} * 100 \text{ ---------- (2)}$$

Net marketing margin deducts operating costs of the actor from the GMM. It shows how profitable is the particular actor in the business. It can mathematically be put as

$$\mathrm{NMM} = \frac{\mathrm{GMM}-\mathrm{CP}}{\mathrm{CP}} \text{ ---------- (3)}$$

In this analysis, marketing cost refers to any expenses incurred by market actors along the value chain, including loading and unloading, transportation, brokerage, and storage costs. The marketing margin analysis was conducted for each actor and location considered in the study.

3. Results and Discussions

3.1 Demographic data

The results in Table 1 show that the average age of respondents was 45.7 years, with an average family size of 6.13 members. Respondents had an average of 12.5 years of beekeeping experience and livestock ownership of 7.4 TLU.

Table 1: Summary statistics for demography related variables of respondents (n=139)

Variable	Mean	Std. Dev.
Age of the household	45.690	±13.510
Family size of the household	6.137	±2.227
Education status	1.755	±0.858
Means of livelihood	3.763	±0.795
Proximity to nearest market in minutes	102.518	±71.097
Proximity to FTCs in minutes	47.460	±44.242
Proximity to main road in minutes	23.237	±28.407
Beekeeping experience of household	12.507	±9.636
Livestock ownership in TLU	7.402	±5.001
Cultivated land in hectares	2.225	±1.587

Source: Survey data, 2020

3.2. Beekeeping outputs marketing

The market dynamics are largely affected by supply, demand, prices, and quality. Beekeeping farmers are the key suppliers of honey while consumers, traders, and collectors dominate the demand side. Honey is the most frequently traded beekeeping product among smallholder farmers in the study areas. However, wax production among beekeepers was minimal and primarily for subsistence use. The limited wax produced was mainly sold to churches and local communities for holidays and ceremonial purposes in small quantities, making it insufficient for broader market analysis. Addisu (2017) similarly found that the majority of beekeepers did not collect beeswax and supply to market at all. Similarly, bee colony marketing involves limited transactions primarily between farmers as suppliers and farmers, NGOs, and research centers as buyers. Given the low market potential and volume of wax and bee colonies, this study focuses on honey as the primary marketing product for analysis.

3.3. Price making power and parameters of beekeepers

Understanding the price-making behaviour in the honey market is crucial. Households were asked about their influence on the price determination of honey they sell. Results showed that 23.19% of respondents felt they could set the price of their honey, while 76.81% believed that market forces determine the price. This finding is consistent with Esubalew *et al*., (2020), which noted that 59.3% of respondents felt that market conditions set the honey price.

Among those who felt they had pricing power, 75% cited the colour of honey as the primary factor influencing price, followed by 17% who pointed to taste, and 5% who considered the timing of the harvest (October-harvested honey being preferred). This differs from Esubalew et al. (2020), which found that only 18% identified honey colour as the main pricing factor.

Table 2: Beekeepers price making power and basis of price making (n=139)

Questions		*Frequency*	*Percent*
Have you price determination power?	Yes	33	23.19
	No	106	76.81
	Total	139	100
If yes, what are your price setting criteria?	Color of the honey	24	72.72
	Taste of the honey	5	15.15
	Harvesting time	3	9.09
	Time of holidays	1	3.04
	Total	33	100
If no, who determines the price?	Buyers	15	14.15
	The market itself	91	85.85
	Total	106	100

Source: Survey data, 2020

3.4. Honey Marketing Actors in the Study Areas

The diagram below (Figure 1) illustrates the honey value chain, detailing the various actors involved at each stage

from inputs to end users. The inputs stage includes suppliers of beekeeping materials, finance, training, and transport, with key players like input traders, NGOs, microfinance, and the agriculture office. Despite these resources available, there is no local policy specifically addressing honey marketing. The producers' stage involves beekeeper farmers and youth groups who are the primary producers of honey, and in the marketing stage, local market collectors, district-level traders, and cooperatives are the main actors who facilitate the sale and distribution of honey. Finally, the end users encompass a wide range of consumers, from local brewery makers and regional buyers to national and international consumers, including cafes and restaurants. This value chain highlights the multi-layered process of honey production and distribution, involving diverse actors from local producers to global consumers.

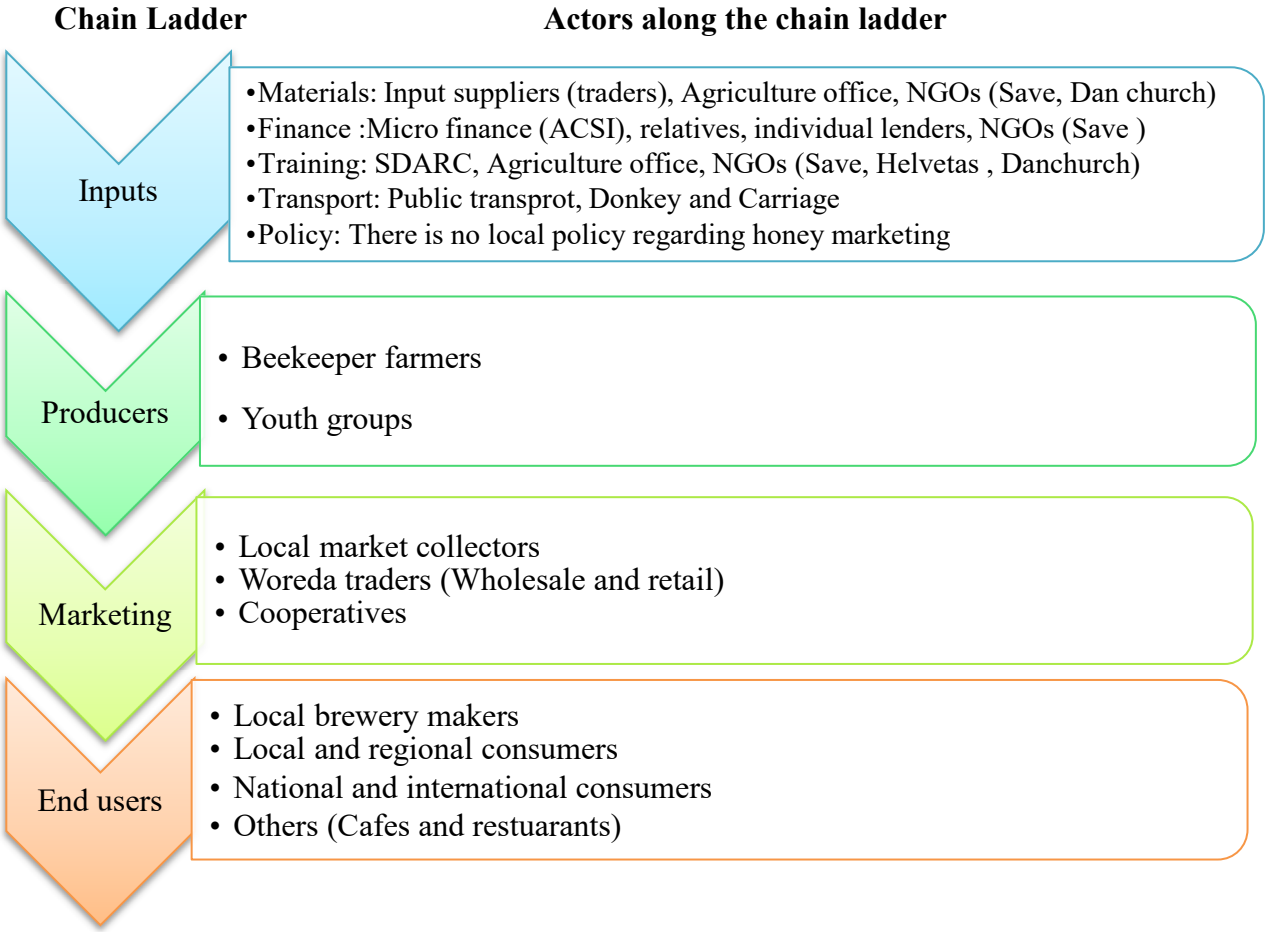

Figure 1: Schematic representation of honey market actors along the value chain

3.5. Honey marketing channels in the study areas

Beekeepers utilize various channels to sell their honey, with eleven channels were identified in this study. This finding aligns with a similar study conducted by Hailemariam and Tolemariam (2017), which identified ten distinct market channels and slightly different from Assefa (2009) identified six market channels.

Channel 1: Producers –Local Consumers = 1.8%
Channel 2: Producers – Local Cooperatives – Consumers =1.2%
Channel 3: Producers – Local Collectors – Local Consumers = 3.4
Channel 4: Producers – Local Collectors – Local brewery makers = 1.5%
Channel 5: Producers – District Cooperatives – Consumers = 9.5%
Channel 6: Producers –Local Brewer makers = 0.2%
Channel 7: Producers – Consumers =7.5%
Channel 8: Producers – Local Collectors – Traders – consumers = (10.4%)
Channel 9: Producers – Traders – Local brewery makers = (12.2%)
Channel 10: Producers – Traders – Consumers = 47.8%
Channel 11: Producers –District Local Brewery Makers = 4.5%

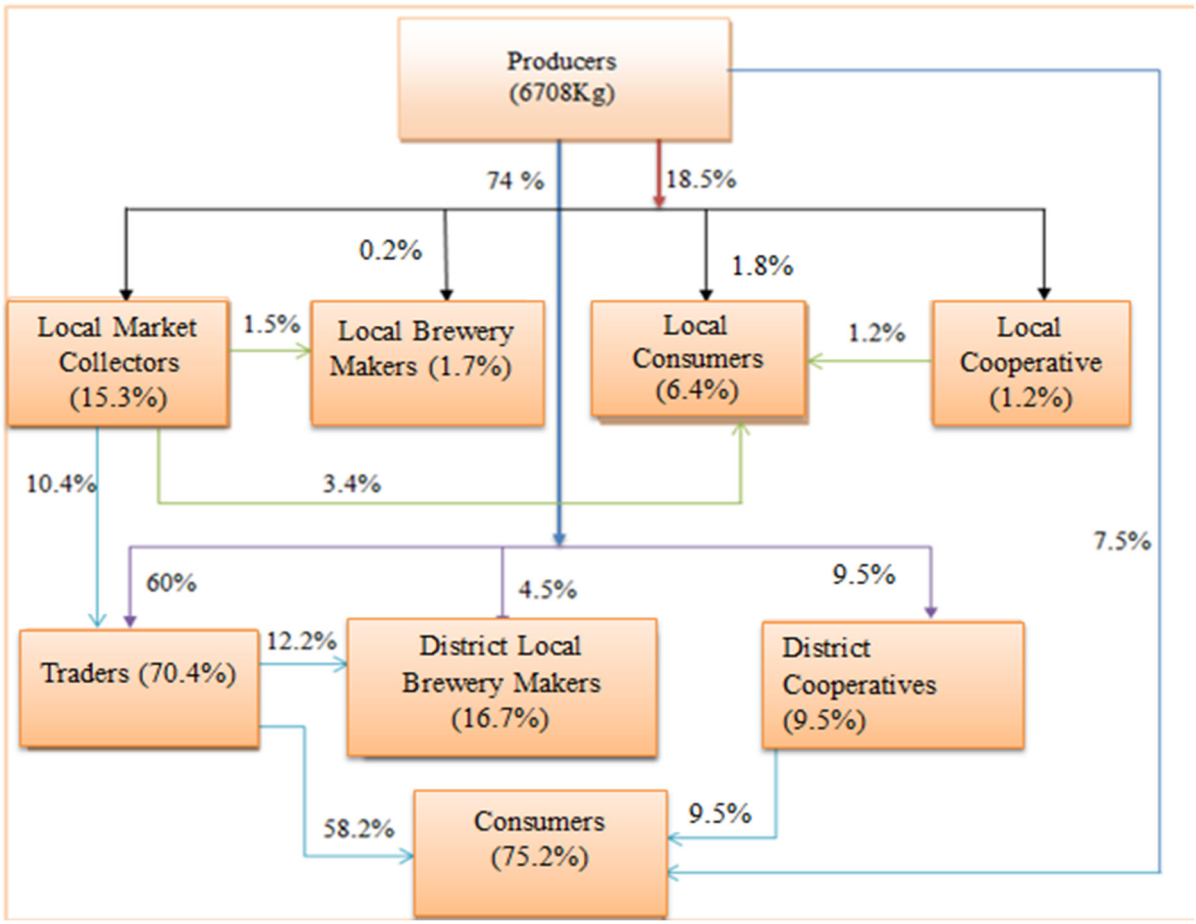

Figure 2: Diagrammatic representation of the flow of honey from producers to consumers

3.6. Market conduct of honey marketing in the study areas

The honey market in the study areas features numerous producers, making it difficult for individual beekeepers to influence prices. Due to their numbers and diversity, their price-setting power is generally limited. However, about 23% of beekeepers claim they set their own prices based on honey quality and production costs. Despite these claims, there are complaints of insufficient buyers at markets, limiting the beekeepers' ability to influence prices.

Interviews with traders revealed that they exert some price-making power across different market levels. The honey market lacks entry barriers, allowing unlicensed traders, known as local market collectors, to participate extensively. These collectors hold a significant share of the value chain, and their presence has created stiff competition, particularly with licensed traders. Additionally, government employees have been noted to act as intermediaries for buyers from larger towns, such as Woldia, Dessie, Mekelle, and Bahir Dar. Overall, it appears that market forces, rather than individual actors, predominantly set prices along the value chain.

3.7. Market performance analysis of honey marketing in the study areas

The performance of the honey market is evaluated using MM calculations, which indicate the share of total market benefits captured by different actors relative to their roles within the value chain. Producers in this study are beekeeper households, while district-level traders are found in towns like Sekota, Tsitsika (Ziquala district), Amdework (Dihana district), and Lalibela (Lasta district). Middlemen, often unlicensed traders, operate between district-level traders and producers across all markets. The marketing costs for district traders include expenses for loading and unloading, transportation, brokerage, and storage. The total marketing margin (TMM) combines the margins of both middlemen and district traders, with Sekota serving as a central hub influencing marketing dynamics in the Wag-himra zone.

In Sekota, producers receive 73% of the consumer price for extracted white honey and 77.5% for crude white honey while for crude yellow and red honey, producers' shares are 64.5%. Middlemen capture the highest MM for crude yellow honey (30%), whereas their lowest share is from crude white honey (27%). For traders, the GMM is highest for crude red honey (11.11%), with net margins of 10.3% and 10.22% for crude red and crude white honey, respectively. Notably, Sekota hosts a farmers' cooperative that offers higher purchase prices to producers, encouraging them to sell to the cooperative to secure better prices and profit shares.

In Dihana, farmers report higher honey prices compared to traders, complicating the calculation of MM. Farmers often sell directly to buyers from other regions who visit Dihana's weekly markets, bypassing local traders who act more as collectors rather than full-scale market participants. There was no enough data to calculate the marketing margin in this district.

At Ziquala Market, beekeepers receive 88.1% of the consumer price for crude white honey and 85.1% for crude red honey, higher than their shares in Sekota. Traders in Ziquala face higher marketing costs (2.5 Birr/Kg) compared to Sekota (0.9 Birr/Kg), which impacts their MM. The net margin for extracted white honey is 8.33%, while it is 3.9% and 3.7% for crude white and red honey, respectively. Middlemen capture 9.1% and 7.1% for crude red and white honey types.

In Lalibella, producers report selling all types of honey, but traders primarily deal in crude white and red varieties. Producers retain 90% of the consumer price for crude white honey. However, due to discrepancies between reported producer and traders' prices, it is challenging to assess marketing shares accurately. Notably, a significant number of producers prefer selling to cooperatives over district traders, distinguishing Lalibella market dynamics from those of other districts.

Figure 3: Marketing margin calculations for honey marketing across district (n=139)

Type of honey		PP	CoP	MMP	CP	GMM	GTM	TNM	MC	TMM	PS
Sekota District	Extracted white	190	260	250	260	24	3.85	3.5	0.9	26.9	73
	Crud white	176	195	203	227	13	10.57	10.22	0.9	22.5	77.5
	Crud yellow	129	170	185	200	30	7.5	7.05	0.9	35.5	64.5
	Crud red	64	-	88	99	27	11.11	10.3	0.9	35.35	64.5
Dehana District	Extracted white	160	-	-	-	-	-	-	-	-	-
	Crud white	156	-	126	140	-	8.9	1.56	-	-	-
	Crud yellow	100	-	-	-	-	-	-	-	-	-
	Crud red	68	-	50	55	-	6.3	1.56	-	-	-
Ziquala District	Extracted white	-	-	190	210	-	9.5	8.33	2.5	-	-
	Crud white	170	-	183	193	7.1	5.18	3.9	2.5	11.9	88.1
	Crud yellow	123	-	-	-	-	-	-	-	-	-
	Crud red	80	-	88	94	9.1	6.4	3.7	2.5	14.9	85.1
Lasta District	Extracted white	264	-	-	-	-	-	-	-	-	-
	Crud white	180	-	180	200	0	10	10	-	10	90
	Crud yellow	80	-	-	-	-	-	-	-	-	-
	Crud red	105	-	80	100	-	20	20	-	20	-

Source: Survey data, 2020

Note: PP=Producers price, CoP=Cooperatives price, MMP=Middlemen price, CP=Consumers price, GMM=Gross middlemen margin, GTM= Gross Traders margin, TNM=Traders net margin, MC=Marketing cost for traders per Kg, TMM=Total Marketing margin, PS=Producers' share

3.8. Price Volatility Analysis of Honey Marketing

Price variations are typically assessed using consumer price indices, which track the behavior of a commodity's price relative to a specified baseline over time. Organizations like the Central Statistics Authority of Ethiopia (CSA) commonly calculate CPIs for a basket of consumer goods to analyze inflation rates. The CPI helps deflate nominal prices to reveal actual price movements and trends. In this study, CPIs were calculated for the monthly average prices of honey across the study locations. However, data availability limited the analysis to the Sekota and Lalibella markets.

3.8.1. Price Volatility at Sekota market

To analyze the inflation rate of honey at the Sekota market, weekly price data were collected from the Wag-himra zone trade office. For simplicity in data management and calculations, monthly average prices were used. The study focused on two main types of honey available during the study period: crude white and crude red honey. As shown in the first table, honey supplies to the market predominantly occurred in October, November, and December each year.

Consumer Price Indices were calculated to assess price volatility in the Sekota market, focusing on month-to-month variations and overall inflation rates over a five-year period, using October 2015 as the baseline (CPI = 100). The average inflation rate over this period was approximately 28% for crude white honey and 8.5% for crude red honey (Table 10).

Crude white honey experienced the highest month-to-month price volatility in 2016, with a dramatic 79% increase from November to March, likely due to low honey supply during that period. The lowest volatility was observed in 2015, with only a 5.4% increase from October to March. Other recorded inflation rates for crude white honey were 7.5% in 2017, around 8% in 2018, and 9.9% in 2019. For crude red honey, the highest monthly inflation

rate was recorded in 2019, showing a 10.8% increase from September to June. The lowest rate occurred in 2007, with a 4.7% increase from October to March. Additional rates were 9.3% in 2017 and 6.8% in 2019 (Table 10).

Table 4: Inflation rate of crud white and crud red honey types at Sekota market

Months	2015		2016		2017		2018		2019	
	Crud white	Crud red	Crud white	Crud red	Crud white	Crud red	Crud white	Crud red	Crud white	Crud red
September						96	115.28301	96		
October	100	100			116.98113	98.6666	116.98113	104	148.78706	130.171
November	101.88679	86.2	76.415094	104	124.52830	114.6667	124.52830	104	151.44654	112
December	105.66037	96.8			132.07547	112	124.52830	104	166.03773	112
January	106.91823	96					124.52830	104	162.26415	112
February	102.26415	96					124.52830	104	143.39622	120
March	115.09434	97.6	188.67924				124.52830	104	143.39622	124.8
April							124.52830	104	147.92452	136
May									140.37735	136.96
June							143.39622	122.66	135.84905	136
July							113.20754	96		
August							119.49685	104		
Average	105.30398	95.4333	132.54717	104	124.52830	105.333	123.23041	104.242	148.83098	124.4368
Deviation	5.4338555	4.76053	79.382742		7.5471698	9.36502	7.9585111	6.89781	9.8947866	10.84534

Source: Lalibella town trade office data (2015-2019)

3.8.2. Price volatility analysis for Lalibella market

A similar price movement analysis was conducted for honey types sold at the Lalibella market over the last five years (2015-2019 E.C.), using the September 2015 average price as the baseline. The honey types available in the market were crude white and red honey. According to the data, honey was typically supplied to the market from October to December each year, except in 2018. Honey production was generally absent from February to June, resulting in no market activity during these months on average.

Table 4 presents the calculated month-to-month and year-to-year inflation rates for both honey types. Using the September 2015 price as the baseline, crude white honey in Lalibella experienced an average price increase of 47% over the five-year period, whereas crude red honey recorded an average inflation rate of 19.5%. Crude white honey showed more than double the inflation rate of crude red honey, reflecting its higher consumer preference among the two types.

Table 5: Inflation rate for crud red and crud white honey at lalibella 2015 September=100

Months	2015		2016		2017		2018		2019	
	Crud white	Crud red	Crud white	Crud red	Crud white	Crud red	Crud white	Crud red	Crud white	Crud red
Sep	100	100	146.3415	124.0310	156.0976	124.0310			185.3659	124.0310
Oct	67.5610	67.8295			136.5854	108.5271	165.8537	108.5271	182.1138	124.0310
Nov	82.9268	78.6822	146.3415	124.0310	136.5854	139.5349			175.6098	124.0310
Dec	98.5366	94.0568	151.2195	131.7829	156.0976	139.5349			173.1707	124.0310
Jan	103.4146	102.3256	156.0976	120.4134	156.0976	124.0310			156.0976	124.0310
Feb	114.3415	97.3643	156.0976	124.0310	160.9756	147.2868				
Mar	126.8293	124.0310	156.0976	124.0310	-	-				
Apr	129.2683	124.0310	165.8537	108.5271	165.8537	139.5349			156.0976	124.0310
May	134.1463	120.1550	175.6098	124.0310	156.0976	124.0310				

Source: Lalibella town trade office data (2015 -2019)

4. Conclusions and Recommendations

4.1. Conclusions

The market structure analysis indicated that eleven market channels were identified and the major product passes through the channel of producers–traders–consumers. Beekeepers predominantly prefer district-level traders for bulk sales and cooperatives for higher unit prices. Local breweries dominate the market for crud red honey, whereas district traders and consumers handle white honey type. Cooperatives offer higher unit prices but have a limited market share, whereas district traders provide competitive benefits despite their larger market share.

The analysis of market conduct and entry barriers indicated that the market is competitive with numerous

buyers and sellers. No significant entry barriers exist in the honey market of the study areas, allowing broad participation. Pricing is influenced by market forces rather than a few dominant actors. The marketing margins analysis also revealed that producers receive the highest prices and share for high-quality honey like extracted and crud white honey. Middlemen, despite being criticized, secure significant margins for lower-quality honey. Traders at Dahina market act more as collectors than wholesalers, and producers achieve better prices and shares for high-quality honey. At Ziquala, producers receive a higher share for crud white honey compared to Sekota.

The price volatility analysis reveals important differences between the two honey types across both markets. Crud white honey exhibits higher price volatility and inflation rates compared to crud red honey, reflecting stronger demand and greater market fluctuations. The analysis over five years shows Lalibella market experiencing the highest inflation rates, with 47% for crud white honey and 19.5% for crud red honey. Sekota market also shows notable inflation, with 28% for crud white honey and 8% for crud red honey. Lalibella exhibits higher month-to-month volatility compared to Sekota.

Based on the study findings, the following recommendations forwarded to enhance the beekeeping sector's efficiency, improve market stability and profitability for producers.

To address gaps in beekeeping inputs access, establish direct linkages between beekeepers and suppliers, including cooperatives. Support beekeepers by providing essential modern equipment. These tools should be available through credit or group purchases to improve both quality and quantity of honey production.

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Conflict of interest:
The authors declare that there is no conflicts of interest regarding the research, authorship, or publication of this article.

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