

Honey and its Socio-Economic Impact on Beekeepers' Households: Case of the IZEGE and KANIOLA Groupings in Walungu Territory, Democratic Republic of the Congo

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Abstract: Physicochemical analysis of the honeys confirmed color intensity values close to each other (-6.77 mm Pfund and 46.38 mm Pfund), pH values close to each other (4.19 and 4.56), moisture content (17.33% and 19.21%), density between 1.40 and 1.42, Brix degree or sugar content between 77.67% and 82.67%, and free acidity between 5 meq/kg and 8 meq/kg with an average of 7 meq/kg, electrical conductivity between 0.005 and 0.007, and ash content between 0.018 and 0.49. These honeys comply with the standards required by the international community.

Financial analysis revealed that honey producers achieve a positive margin through beekeeping production and honey sales activities. With an overall turnover of 112,125,228.64 CDF, an overall net result of 214,295,173.85 CDF, the Value Added to Intermediate Consumption ratio stands at 23.34 Congolese francs, and the Net Income to Total Cost ratio gives a positive figure of 23.00 Congolese francs. This implies that the beekeeping sector is profitable and that every Congolese franc spent yields 23 francs per year to the beekeeper. The analysis of the impact that beekeeping income would have on satisfying the socio-economic needs of beekeepers' households shows that 100% of survey respondents view beekeeping as a vital response to food security and schooling issues, 29% maintain that beekeeping allows them to save for the future, and 5% stated that beekeeping enables them to acquire certain beekeeping equipment and materials.

Keywords: *Socio-Economic Impact, Honey Quality.*

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I. INTRODUCTION

Honey is described as a sweet substance of natural origin, produced by honey bees from flower nectar or honeydew. Its composition mainly depends on several factors such as its geographical origin, harvest season, colony health, environmental conditions, and the beekeeping practices used (Bakenga et al., 2002).

Currently, honey is subject to speculation regarding its physicochemical qualities. Furthermore, consumers are unable to verify the purity of their honey due to the lack of

official structures controlling the quality of local products. Its composition and properties vary considerably depending on its botanical origin and production conditions.

Honey is valuable as a food, remedy, and marketable commodity in both national and export markets, and plays an important role in certain cultural traditions (Bouddaha k et al., 2015). Moving forward, we increasingly seek to prove the quality and authenticity of our production by carrying out several essential physicochemical analyses and applying Codex Alimentarius standards (2001).

To be sold under the designation "honey", no substance (other than honey) may be added. Honey is in a finished state in the hive—meaning it is a so-called "primary" product (unprocessed). Regulations set certain criteria regarding the composition and quality of honey.

Honey is widely used in several countries due to its various virtues, being used for both therapeutic and dietary purposes. It is therefore a highly consumed (appreciated, liked) food and medicine. Thus, for commercial and economic reasons, certain honeys are often counterfeit or adulterated. Consuming these honeys could inevitably cause significant harmful effects on consumer health. This raises the issue of honey quality for consumer health (Koudegnan et al., 2021).

However, it should be emphasized that a significant share of honey production in Africa—namely 50%—is sold through traditional informal channels without quality control. This situation casts doubt on the product's authenticity and makes it subject to risks of alteration.

This study aims to better understand the honeys produced and sold in the IZEGE and KANIOLA region by focusing on determining physicochemical characteristics such as moisture content, total sugar content or Brix degree, density, color intensity, free acidity, ash content, electrical conductivity, and pH, and verifying their compliance with international Codex Alimentarius quality standards.

The economic interest of this study lies in quality control and the valorization of hive products. On the health level, it aims to guarantee food safety for consumers of honey from these aforementioned areas. This brings up the issue of honey quality for consumer health. It can be assumed that honeys from the IZEGE and KANIOLA groupings fully respect the standards proposed by the Codex Alimentarius Commission.

In the Izege and Kaniola groupings, beekeeping is an important but still under-studied practice. Its socio-economic impact on local households has not yet been sufficiently documented, leaving a gap in understanding its potential as a rural development tool. The assessment of the socio-economic importance of beekeeping therefore remains an under-explored topic in the DRC, particularly in the Izege and Kaniola groupings. It is therefore necessary to highlight the assets of beekeeping and its real socio-economic contribution in the Kaniola and Izege groupings, where beekeeping has been practiced for a long time.

This situation raises important questions regarding the real contribution of beekeeping in meeting the socio-economic needs of beekeeping households, the key factors determining the success of beekeeping in these regions, the major challenges hampering the development of this sector and how they influence the well-being of beekeepers, as well as the main obstacles and opportunities in this value chain.

This study aims to analyze the socio-economic impact of beekeeping on households in the Izege and Kaniola groupings. It seeks to understand to what extent this activity contributes to beekeepers' income, identify the factors influencing its practice as well as the constraints encountered, and evaluate its role in the well-being of local households. Beekeeping, thanks to the economic benefits of honey, would constitute a significant source of income increase and wealth creation for beekeepers in the Izege and Kaniola groupings.

This research adopts a mixed-methods approach, combining quantitative and qualitative methods. The study will focus on a representative population of beekeepers in the Izege and Kaniola groupings using the snowball sampling method, covering a two-and-a-half-year period from January 2022 to June 2024. Data were collected through surveys, semi-structured interviews, and direct observation, and will be analyzed using appropriate statistical techniques and financial analysis for cost and profitability assessment.

II. MATERIALS AND STUDY METHODS

➤ *Presentation of the Study Area*

This study was carried out in the Ngweshe Chiefdom, which includes the IZEGE and KANIOLA groupings, in the territory of Walungu, consisting mainly of hills, plateaus, and lowlands in valleys or swamps crossed by rivers. It is part of the natural region of South Kivu commonly known as the "Kivu Ridge" (Dorsale du Kivu) and extends on either side of the mountain range that borders the Graben west of Lake Kivu and the upper reaches of the Ruzizi River. The altitude ranges between 1,460 m and 2,000 m, the latitude varies between 2°30' and 2°42' South, and the longitude between 28°46' and 28°50' East (Sika, 2009).

The region benefits from large amounts of rainfall distributed over two seasons of unequal duration: a major rainy season that begins in September and ends in December with a peak in November, and another shorter humid season from mid-March to mid-May with a peak in April (Dupriez, 1987).

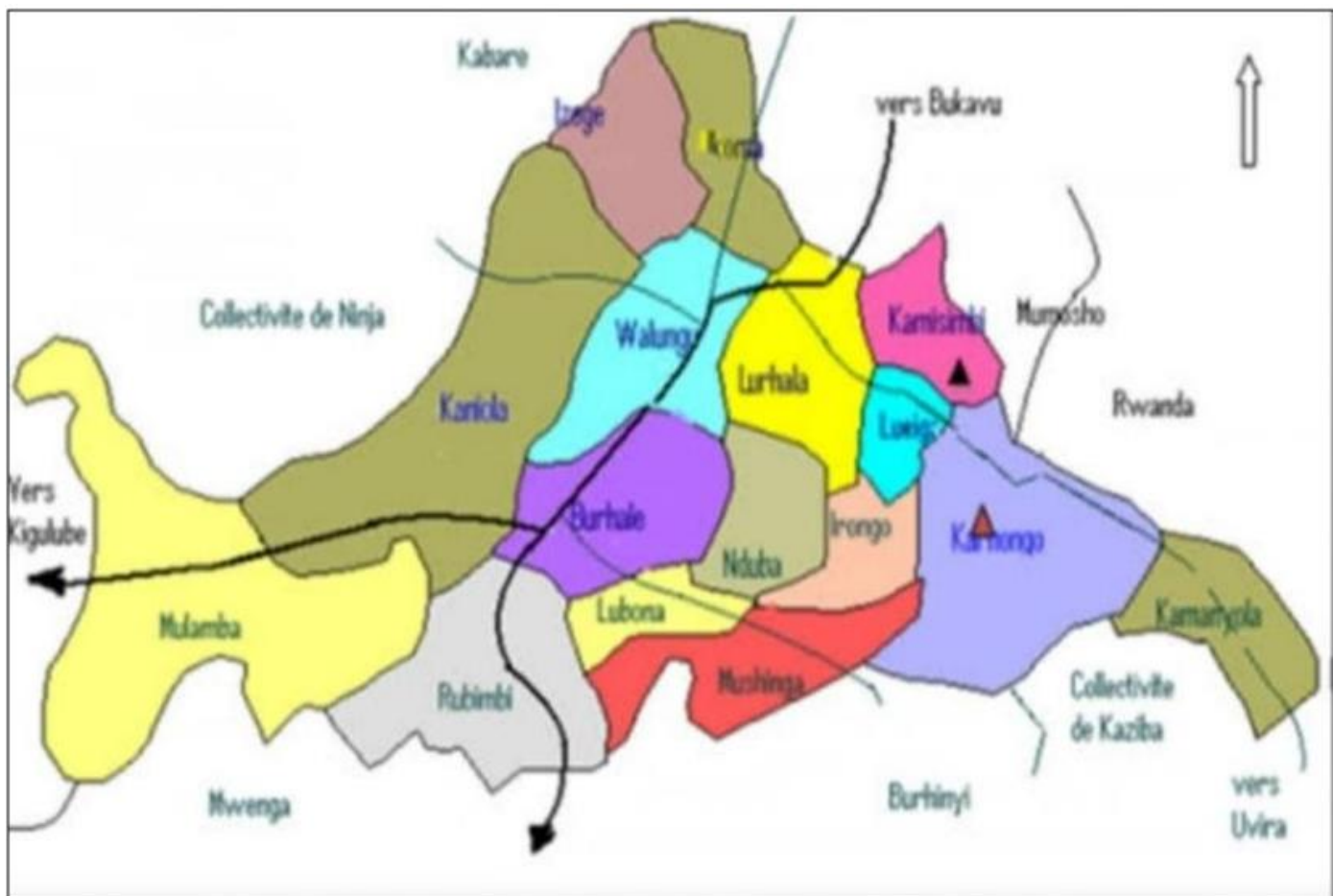


Fig 1 Represents the Map of the WALUNGU Territory and its Various Groupings.

➤ Sampling

• Honey Sample Collection for Analysis

The 30 honey samples analyzed were collected from 30 beekeepers in the IZEGE and KANIOLA groupings. Their apiaries are located in wooded areas dominated by species from the Myrtaceae and Asteraceae families. Species belonging to the Acanthaceae, Poaceae, and Fabaceae families are also identified there. Around these apiaries, polyculture of maize, beans, and banana trees is also practiced.

This study focuses on these samples collected from January to December 2024, preserved in the laboratory in a dry, shaded environment under ambient humidity, labeled out of reach of third parties, and kept according to good hygiene practices. This research work was carried out in the laboratory of the Biochemistry and Molecular Biology Teaching and Research Unit (Prof. Bakenga) in the Department of Biology at ISP BUKAVU, Democratic Republic of the Congo. These various samples were used for all physicochemical analyses.

• Socio-Economic Study

For this socio-economic study of beekeeping, the analyzed data are based on a sample of 61 beekeepers distributed across twenty villages in the IZEGE and KANIOLA groupings. The sample was gathered using the snowball sampling method, with a initial core of 30

beekeepers identified as direct actors for the primary survey. These first respondents served as connectors to reach a further 31 beekeepers. Some participants were interviewed in focus groups, while others were surveyed through individual interviews.

➤ Methodological Framework and Equipment

• Determination of Physicochemical Parameters

Physicochemical analysis of honey is essential for assessing its quality, authenticity, properties, and typicity. It allows for the determination of several major parameters based on well-defined international standards and references. All these analyses were carried out in the laboratory of the Biochemistry and Molecular Biology Teaching and Research Unit at I.S.P./Bukavu, Democratic Republic of the Congo.

• Color Intensity

The color of the samples was determined by diluting 2 g of the sample in warm water at 50 °C (1:1, w/v); absorbance was then measured using a spectrophotometer (Thermo Fisher Scientific model 4001/3) at 635 nm. Results were expressed in millimeters on the Pfund scale:

$$\text{Pfund} = -38,70 + 371,39 \times \text{Abs. (Achouri et al, 2021).}$$

- *Moisture, Density, and Sugar Content*

To determine these 3 parameters (density, moisture, and Brix degree or total sugar content), a drop of honey is placed on the prism of a refractometer (portable refractometer model RHB 90ATC). The results are then read through the eyepiece of the refractometer (Bogdanov et al., 2004; Codex Alimentarius, 2001).

- *The refractometer provides 3 readings at 20 °C:*

- ✓ Water content: expressed as a % of the honey;
- ✓ Brix degree: expressed in °Brix, indicating the total sugar content of the honey;
- ✓ Baumé degree: indicating the density (\$d\$) of the honey.

$$d = \frac{145}{145 - B}$$

- *pH*

The pH is determined using a pH meter calibrated with standard buffer solutions on a 10% honey solution.

- *Free Acidity*

Free acidity is determined by potentiometric titration. To 2 g of honey, 20 ml of distilled water is added, followed by 4 to 5 drops of phenolphthalein indicator. The solution is titrated with 0.1 N NaOH solution. Acidity is expressed in milliequivalents of sodium hydroxide required to neutralize 1 kg of honey, calculated using the following formula:

Free Acidity = $\text{ml de NaOH } 0,1\text{N} \times 10$; with NaOH :
(where NaOH is caustic soda; Boussaha K., 2015).

The free acidity of honey must be under 50 meq NaOH/kg (according to the standard established by Codex Alimentarius 1981, amended and revised in 2022).

- *Ash Content*

Ash content determination is based on honey incineration in a CARBOLITE GERO CWF 1100 furnace. 10 g of honey is heated at 550 °C for 3 hours.

- *Electrical Conductivity (EC)*

A Model 8603 EC conductivity meter was used to determine the electrical conductivity values of the honey samples.

➤ *Data Collection and Processing on the Socio-Economic Impact of Beekeeping*

This stage is based on a combination of qualitative methods (focus group discussions, semi-structured interviews) and quantitative methods (questionnaire administration to beekeepers).

- *Exploratory Survey*

An exploratory study was conducted to identify all honey value chains in the Izege and Kaniola groupings and the actors involved in their operation. For this purpose, semi-structured interviews and focus group discussions were

carried out using interview guides. Target interlocutors during this phase included beekeepers and honey consumers.

- *In-Depth Survey*

Data collection was conducted using a questionnaire administered through face-to-face interviews. The main points addressed in the interviews included: identification of beekeepers, socio-demographic characteristics, roles in the honey value chain, organizational modes of activities, volume of activity (quantity of products handled), upstream and downstream commercial partners, inventory of operational costs incurred, revenue generated, and constraints encountered.

➤ *Data Analysis and Processing*

- *Financial Analysis of Honey Production*

Financial analysis was conducted using the cost analysis methodology of Sodjinou et al. (2011) and FAO (2017), alongside financial profitability analysis methods inspired by Lebailly et al. (2000) and Tallec & Bockel (2005).

- *Cost Analysis*

Production, collection/packaging, and marketing costs were calculated for each beekeeper. Cost structures were then evaluated to identify expense items where interventions could improve value chain performance. Total costs (TC) are calculated per beekeeper : $TC = VC + FC$ (1) ; where CV represents variable costs and FC fixed costs.

- *Financial Profitability Analysis*

Financial profitability analysis was conducted at the individual actor (beekeeper) level by calculating value added and net income. For a given beekeeper, Value Added (VA) is determined as: $VA = GP - IC$

(2) (where GP is gross product and IC is intermediate consumption).

Gross product (GP) is obtained by multiplying the produced quantity by the unit price. It represents turnover—the sum of revenue generated by product sales. Net income (NI) for an actor is calculated as the difference between gross product (GP) and total costs (TC):

$$NI = GP - TC = V - (\text{Labor Costs} + \text{Financial Costs} + \text{Taxes} + \text{Depreciation quad (3)})$$

Consolidated net income and value added were established for beekeepers after calculating individual values for each grouping. Consolidation involves compiling a single account for all beekeepers, considering only exchanges between value chain links and external agents. Finally, value added distribution between beekeepers in both groupings was analyzed (Lebailly et al., 2000; Tallec & Bockel, 2005).

Economic/social profitability across the value chains was also calculated as the difference between gross revenue and total costs evaluated using product and input market prices. An economic profitability value greater than zero indicates that the value chain is economically viable.

- *Beekeeping Feasibility Analysis*

The feasibility study of beekeeping in both groupings was conducted using a participatory approach. This approach aims to evaluate local feasibility while identifying relevance, constraints, and assets to consider for successful implementation.

- *Three Dimensions of Feasibility were Evaluated:*

- ✓ Environmental feasibility;
- ✓ Technical readiness/feasibility;
- ✓ Socio-economic and cultural feasibility.

Environmental feasibility focused on vegetation characteristics by reviewing melliferous plant species present, their abundance, and flowering periods, along with environmental factors like water sources and ambient temperature. Technical feasibility examined the beekeeping calendar, equipment availability, local capacity for training/monitoring, and local equipment manufacturing skills.

➤ *Statistical Data Processing*

Survey data collection was conducted via questionnaires, with responses imported into a Google Form linked directly to an Excel spreadsheet for secure storage and rapid processing. Data processing and statistical analysis were performed using Microsoft Word, Microsoft Excel, and IBM SPSS 15.

III. RESULTS AND DISCUSSION

➤ *Determination of Physicochemical Parameters of Honeys*

- *Color Intensity*

Color intensity values ranged between -6.77 mm Pfund and 46.348 mm Pfund, corresponding to extra light amber, extra white, and water white. Color serves as an indicator of honey origin and is tied to chemical composition, storage duration, mineral content, chlorophyll, carotenoids, tannins, and phenolic compounds (Amine, 2019). Darker honeys have been shown to contain higher phenolic compound levels.

Honey coloration stems from pigments such as dyes (carotenoids) and flavonoids linked to botanical and geographical origin. However, color variations can also result from contact with heavy metals, exposure to high temperatures or light, or aging (Muka et al., 2022). Color intensity values for our samples ranged from -6.77 mm Pfund (LUV) to 46.348 mm Pfund (M.V). These results fall within the range reported by Amine (2019) for honeys from the Fès-Meknès region (-0.43 to 38.70 mm Pfund).

- *Moisture Content, Sugar Content, and Density*

Moisture content in the studied samples ranged from 17.33% (M.V) to 19.24% (LUV). These values fall well below the maximum limit of 20% specified by Codex Alimentarius (2001), confirming a very low risk of fermentation. Consequently, these samples can be stored without risk of deteriorating their physicochemical properties.

Koula et al. (2014), analyzing honeys of various origins, reported moisture values between 13.4% and 17.2% (average 17%). Our moisture values align with findings by Hasna & Radia (2014) on Algerian honeys (17.2% to 19%) and Mourad et al. (2024) on honeys from Béni Mellal-Khénifra (17.5% to 20.5%). All sample moisture values comply with standard specifications (Codex Alimentarius 2022), confirming acceptable quality.

Codex Alimentarius and European Union standards currently allow a maximum moisture limit of 21%. Honeys with high moisture content ferment more readily (Codex, 2001), whereas fermentation does not occur below 15% moisture. Moisture variation depends on environmental factors such as climate, floral origin, nectar water content (Bogdanov et al., 2004), as well as processing techniques and storage conditions.

Density values obtained ranged between 1.40 and 1.42, closely matching results reported by Hoyet (2005). This similarity stems from comparable water content levels across the analyzed honeys, directly governing density.

Total sugar content values ranged between 77.67% and 82.67%, complying with Codex Alimentarius (2022) requirements (minimum 60%). These values are slightly lower than those found by Hamza & Abdenour (2018) (82.5% to 90%, average 84.89%), a variance likely attributable to floral sources, honey maturity at harvest, or storage conditions. According to Terrab et al. (2001), carbohydrates in honey consist mainly of reducing monosaccharides such as glucose and fructose, which together account for 90% of total dry matter.

- *Hydrogen Potential (pH)*

pH measurements, which indicate the acidic reaction of honeys, ranged between 4.19 and 4.56. All samples were thus characterized as acidic, fully complying with Codex Alimentarius standards (2001). Bakchiche et al. (2017) reported pH values ranging from 3.97 to 4.65 (average 4.3), noting that honey is naturally acidic regardless of geographical origin due to organic acids that contribute to flavor and microbial stability.

These pH values align with other honey studies, including Hamidat & Chaima (2022) (3.97 to 4.50), Djossu et al. (2013) (3.57 to 5.30, average 4.29), and Laurino & Gellia (1990) (3.2 to 4.6, average 3.9). None of our samples exceeded permissible limits, serving as an indicator of freshness and overall good quality.

pH also helps determine floral origin: blossom/nectar honeys typically range between 3.50 and 4.50, whereas honeydew honeys range between 5.00 and 5.50 (Gonnet, 1986). All analyzed samples are therefore confirmed as nectar honeys.

- *Free Acidity*

Free acidity in honey results from organic and inorganic acids. Codex Alimentarius sets a standard maximum of 40 meq/kg, extended to 50 meq/kg for honeys with naturally higher acid contents (Hamza & Abdenour, 2018). Samples exceeding this limit risk rapid degradation under improper

harvest or storage conditions.

Values across our samples ranged from 5 meq/kg (M.B) to 8 meq/kg (SAN), averaging 7.08 meq/kg. These values are significantly lower than those reported by Hamza & Abdenour (2018) (19.94 to 53.72 meq/kg, average 30.53 meq/kg) and Kadidja et al. (2019) (19 to 44 meq/kg, average 32.14 meq/kg). None of the samples exceeded permissible limits, demonstrating high quality regarding free acidity.

- **Electrical Conductivity (EC)**

Electrical conductivity values ranged between 0.005 and 0.007 mS/cm. Under Codex standards (2001), electrical conductivity must not exceed 0.80 mS/cm. These values further confirm all samples as nectar honeys, as nectar honey conductivity falls within 10-4 to 5x 10-4 s / cm (Gonnet, 1986). This parameter depends on mineral content and acidity: higher mineral concentrations yield higher conductivity (Guerzou & Nadji, 2009).

- **Ash Content**

Ash content values ranged between 0.018% and 0.49%. Ash content depends on botanical origin. All results comply with international standards (below 0.6% for nectar honey and under 1.0% for honeydew or mixed honey).

➤ **Socio-Economic Study**

- **Socio-Demographic Characteristics of Respondents**

Analyzed data were collected from a sample of 61 beekeepers across two groupings in Walungu Territory: 30 in the Izege grouping and 31 in the Kaniola grouping.

- ✓ **Gender Distribution of Beekeepers**

The table below shows the gender distribution of surveyed beekeepers...

Table 1 Gender Distribution of Beekeepers

Observation (x _j)		Frequency	%	Valid%	Cumulative
61	MALE	47	77,0	77,0	77,0
	FEMALE	14	23,0	23,0	100,0
	Total	61	100,0	100,0	

23% of the beekeepers surveyed during the actual field study are women, while men represent 77% of the beekeepers.

- ✓ **Household Size**

The table below presents household size:

Table 2 Household Size

	Minimum	Maximum	Mean	Standard Deviation
Individus dans le ménage	2	18	8,44	3,571
N (61)				

A total of 61 households were represented in our sample. Thus, the average household size is 8 individuals; the smallest household comprises 2 people, while the largest comprises 18, with an average deviation of 4 individuals between households.

- ✓ **Age Distribution of Beekeepers**

The table below shows the age distribution of beekeepers:

Table 3 Age Distribution of Beekeepers

	Minimum	Maximum	Mean	Standard Deviation
Age	16	78	47.59	14.570
N (61)				

The minimum age of the beekeepers is 16 years, and the maximum is 78 years, with an average age of 47.59 years and a standard deviation of 14.5 years. It is observed that the surveyed beekeepers are predominantly adults.

- ✓ **Educational Level of Beekeepers**

The table below provides information on the educational attainment of the beekeepers:

Table 4 Educational Level

N	Observation (x _j)	Frequency	%	Valid %	Cumulative %
61	UNIVERSITY	4	6.6	6.6	6.6
	SECONDARY	19	31.1	31.1	37.7
	PRIMARY	17	27.9	27.9	65.6
	OTHER / NONE	21	34.4	34.4	100.0
	Total	61	100.0	100.0	

Beekeeping in Izege and Kaniola is not restricted solely to uneducated individuals. In fact, 65.6% of the beekeepers have attended at least primary school. It is also noted that 34.4% (21 out of 61 beekeepers) have never attended formal school.

✓ *Primary Activity of Beekeepers*

The primary occupations of the beekeepers are outlined in the following table:

Table 5 Primary Activity

N	Observation (xj)	Frequency	%	Valid %	Cumulative %
61	Apiculture / Beekeeping	18	29.5	29.5	29.5
	Agriculture / Farming	32	52.5	52.5	82.0
	Commerce / Trade	1	1.6	1.6	83.6
	Artisanat / Crafts	4	6.6	6.6	90.2
	Fonctionnaire / Civil Servant	6	9.8	9.8	100.0
	Total	61	100.0	100.0	

The collected data demonstrate that beekeeping is not the sole activity of these farmers. Alongside beekeeping, agriculture, trade, handicrafts, and civil service are practiced by many beekeepers. At 52.5%, farming remains the most predominant activity, with beekeeping ranking second at 29.5% (18 out of 61 beekeepers practice beekeeping as their main occupation), followed by civil service, handicrafts, and trade.

✓ *Secondary Activity of Beekeepers*

Data collected showed that beekeeping was primarily a secondary activity for a significant proportion of respondents (68.9%). Agriculture ranked second as a secondary activity (21.3%), followed by trade, handicrafts, and civil service at 4.9%, 3.3%, and 1.6%, respectively.

Table 6 Secondary Activity

N	Observation (xj)	Frequency	%	Valid %	Cumulative %
61	BEEKEEPING	42	68.9	68.9	68.9
	FARMING	13	21.3	21.3	90.2
	TRADE	3	4.9	4.9	95.1
	CRAFTS	2	3.3	3.3	98.4
	CIVIL SERVANT	1	1.6	1.6	100.0
	Total	61	100.0	100.0	

(Source: Our Analysis, October 2024)

✓ *Function in the Beekeeping Value Chain*

The table below outlines the role of beekeepers within the honey value chain:

Table 7 Links in the Honey Value Chain

N	Observation (xj)	Frequency	%	Valid %	Cumulative %
61	Producer	58	95.1	95.1	95.1
	Consumer	2	3.3	3.3	98.4
	Seller	1	1.6	1.6	100.0
	Total	61	100.0	100.0	

95.1% of survey respondents function as producers in the honey value chain, 3.3% act as consumers, and 1.6% operate as honey sellers.

➤ *Honey Production Factors*

✓ *Seniority in Beekeeping*

The table below displays the years of experience of beekeepers in beekeeping activities:

Table 8 Seniority in Beekeeping

Seniority Range (years)	Number of Beekeepers	Percentage (%)
1 to 5 years	18	29.50%
6 to 10 years	12	19.70%
11 to 16 years	10	16.40%
17 to 20 years	8	13.10%
21 years and above	13	21.30%
Total	61	100%

Seniority in the beekeeping sector varies between 1 and 50 years. It is observed that the sector is not currently in a rapid growth phase, and new beekeepers are not joining regularly, given the high values of mean seniority and the standard deviation between years of experience.

✓ *Training Prior to Starting Beekeeping*

The table provides information on beekeepers' training prior to initiating their activities:

Table 9 Training in Beekeeping

N	Observation (xj)	Frequency	%	Valid %	Cumulative %
61	No	43	70.5	70.5	70.5
	YES	18	29.5	29.5	100.0
	Total	61	100.0	100.0	

70.5% of beekeepers received no training in beekeeping prior to entering the sector, and only 29.5% reported receiving some form of training or awareness raising from development NGOs and non-profits, notably APIKIVU, whose beneficiaries were interviewed during the survey.

✓ *Land Area Used for Beekeeping*

The table below presents the land area utilized for beekeeping activities:

Table 10 Land Area Exploited

N	Observation (xj)	Frequency	%	Valid %	Cumulative %
61	0–1 Ha	31	50.8	50.8	50.8
	1–5 Ha	24	39.3	39.3	90.2
	5–10 Ha	5	8.2	8.2	98.4
	Over 15 Ha	1	1.6	1.6	100.0
	Total	61	100.0	100.0	

Beekeeping in the two studied groupings is mostly carried out on small land plots. 50.8% of beekeepers practice on areas of one hectare or less; 39.3% operate on 1 to 5 hectares; 8.2% operate on 5 to 10 hectares; and only 1 farmer reported utilizing over 15 hectares for their beekeeping

operation.

✓ *Land Ownership*

The table below details land access tenure:

Table 11 Land Access

N	Observation (xj)	Frequency	%	Valid %	Cumulative %
61	Tenants	30	49.2	49.2	49.2
	Owners	31	50.8	50.8	100.0
	Total	61	100.0	100.0	

Nearly half of the beekeepers do not hold property rights over the land used for their beekeeping operations. 30 out of 61 surveyed beekeepers access land through temporary lease agreements. This situation creates significant uncertainty for tenants, who reported being subject to sudden eviction by landowners, presenting a major barrier to sector development. However, rental costs remain relatively

affordable according to most beekeepers, with an average annual rent of 41,541.23 CDF and a maximum annual rent of 150,000 CDF.

✓ *Types of Hives Used and Colonization Rate*

The table below presents the types of hives used:

Table 12 Hive Types

	Total	Mean	Standard Deviation
Total number of hives	3,484	57.21	67.711
Top-bar hives (Kenyan)	40	0.66	2.016
Other hives	3	0.05	0.384
Traditional hives	3,441	58.33	67.274
N valide	61		

In total, 3,484 hives were deployed by the surveyed beekeepers, including 3,441 traditional hives, 40 Kenyan top-bar hives, and 3 other unspecified hive types. A major disparity exists between the types of hives used as well as in hive ownership per beekeeper, with a standard deviation of 57 hives. Traditional hives account for 3,441 out of 3,484 hives

(98.7%)

Data analysis reveals colonisation percentages by hive type. Calculating the colonization rate (populated hives divided by total hives installed) shows that traditional hives have a colonization rate of 62.1%, Kenyan top-bar hives

82.5%, and other hives 100%. The overall colonization rate across all categories stands at 62.45%.

Table 13 Colonization Rate

Type	Total Number	Populated Hives	Colonization Rate
Traditional hives	3,441	2,140	62.19%
Kenyan top-bar hives	40	33	82.50%
Other hives	3	3	100.00%
Total	3,484	2,176	62.45%

✓ Labor Supply

Table 14 Labor Supply Type

N	Observation (xj)	Frequency	%	Valid %	Cumulative %
61	FAMILY LABOR	54	88.5	88.5	88.5
	HIRED LABOR	7	11.5	11.5	100.0
	Total	61	100.0	100.0	

Beekeeping labor is predominantly family-based (88.5%), while hired labor accounts for only 11.5%.

➤ Economic and Financial Analysis of the Honey Production Chain

• Expense Structure

✓ Investment Cost Analysis

The table below presents initial equipment costs and investments:

Table 15 Investment Costs in CDF (1 USD = 2,800 CDF)

Item	Total	Mean	Standard Deviation
Hives	25,899,800.00	424,586.89	470,695.810
Honey extractors	73,000.00	1,196.72	6,857.647
Frame lifters	12,000.00	196.72	1,077.337
Honey strainers	123,500.00	2,024.59	7,187.041
Smokers	120,000.00	1,967.21	9,969.900
Others	212,000.00	3,475.41	7,775.188
TOTAL	26,440,300.00		

Beekeepers in both groupings invested in the sector by acquiring hives, honey extractors, frame lifters, honey strainers, smokers, and small accessories like jerrycans and empty bottles. The most significant investment item is hive acquisition, accounting for 25,899,800 CDF (98% of total invested funds).

✓ Operational Cost Analysis

The table below summarizes intermediate consumption:

Table 16 Intermediate Consumption in CDF

Item	Total	Mean	Standard Deviation
Hired labor	1,356,000.00	22,229.51	113,886.697
Hive maintenance	834,000.00	13,672.13	38,650.882
Land lease	2,129,000.00	34,901.64	63,567.734
Training & consultancy	154,000.00	2,524.59	17,984.814
Other costs	189,000.00	3,098.36	18,021.936
Overall production cost	4,662,000.00		
Average cost per beekeeper	76,426.22		

Beekeeping operating costs in the Izege and Kaniola groupings were grouped into five main categories: hired labor, hive and apiary maintenance, land lease fees, training and consultancy fees, and other costs (transportation and packaging for marketing). The overall annual cost for the honey value chain is 4,662,000 Congolese francs, corresponding to an average annual cost of 76,426.22 CDF per beekeeper.

- *Revenue Streams*

- ✓ *Yield Analysis*

The table below provides yield figures per hive type:

Table 17 Hive Yields

Hive Type	Quantity	Average Yield per Hive (L)	Annual Production (L)
Populated traditional hives	2,140	4.10	8,774.00
Populated top-bar hives	33	4.10	135.30
Populated other hives	3	4.10	12.30
TOTAL	2,176		8,921.60

Analyzing yields yields an average annual production of 4.10 liters of honey per hive. Given their dominant proportion in local apiaries, traditional hives represent the largest share of total production (8,774.00 liters/year), while Kenyan top-bar hives produce 135.30 liters and other hives 12.30 liters. Total annual filtered honey production in the sector is estimated at 8,921.60 liters.

- ✓ *Honey Production and Turnover Analysis*

The table below details production allocation and gross turnover:

Table 18 Honey Production and Turnover in CDF

Indicator	Value
Total production in liters (A)	8,774.00
Quantity consumed by household (B)	2,970.55
Quantity sold in liters (C)	5,823.45
Average price per liter (D)	19,254.10
Total production value	168,935,473.40
Value of home consumption	57,195,266.75
Global turnover	112,125,228.64
Mean turnover per beekeeper	1,838,119.48

Total annual sector production stands at 8,774.00 liters of filtered honey. Not all production reaches the market, as 2,970.55 liters are consumed by beekeeping households. Consequently, turnover calculation accounts only for the commercialized share (5,823.45 liters). Sold at an average price of 19,254.10 CDF per liter, this yields a total sector turnover of 112,125,228.64 CDF, representing an average turnover of 1,838,119.48 CDF per beekeeper.

- ✓ *Financial Profitability Indicators Analysis*

The table below outlines financial performance metrics:

Table 19 Financial Performance Indicators in CDF

Indicateur / Indicator	Total	Individual Mean
Turnover (E)	112,125,228.64	1,838,118.50
Intermediate consumption (F)	4,662,000.00	76,426.22
Net operating result (E - F) Labor Value Added	107,463,228.64	1,761,692.27
	+ 1,356,000.00\$	+ 22,229.51\$
	=108,819,228.64\$	= 1,783,921.78\$
Intermediate Consumption Ratio (VA / F)	23.34	—
F (Net Income / Total Cost Ratio)	23.00	—

Financial performance analysis using the value-added framework demonstrates that honey producers achieve positive margins from beekeeping and honey sales. With a global turnover of 112,125,228.64 CDF against intermediate consumption of 4,662,000.00 CDF, the value-added ratio (VA / Intermediate Consumption) reaches 23.34 CDF, while the Net Income to Total Cost ratio yields a positive value of 23.00 CDF.

- *Impact of Beekeeping on the Well-Being of Beekeepers' Households*

The following Figure 2 shows the impact of beekeeping on social well-being

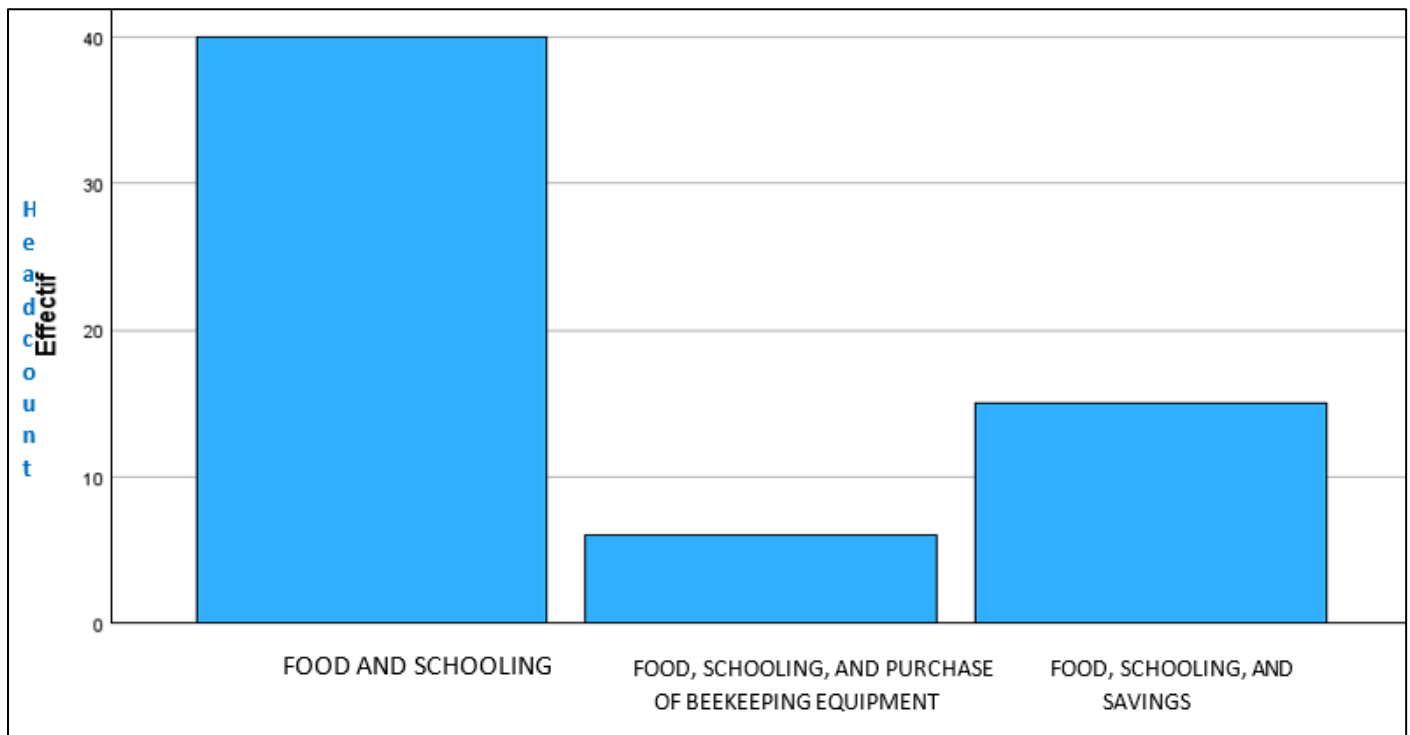


Fig 2 Impact of Beekeeping on Well-Being

During the surveys, beekeepers demonstrated that beekeeping was essential for their households, especially regarding the satisfaction of basic needs such as food, education, savings, and the acquisition of small beekeeping equipment.

100% of respondents view beekeeping as a solution to food and schooling challenges, 29% maintain that beekeeping allows them to save for the future, and 5% stated that beekeeping is an activity that enables them to acquire certain beekeeping equipment and materials.

IV. DISCUSSION

The analysis of the financial performance of beekeeping, evaluated through the concept of value added, shows that honey producers achieve a positive margin from beekeeping activities and honey sales in these regions (Table 22).

The analysis of financial performance based on the concept of value added shows that honey producers achieve a positive margin through beekeeping production activities and honey sales. With an overall turnover of 112,125,228.64 CDF and intermediate consumption amounting to 4,662,000 CDF, this yields an overall value added of 214,295,173.85 CDF. The Value Added (VA) to Intermediate Consumption (IC) ratio stands at 23.34 CDF, and the Net Income (NI) to Total Cost (TC) ratio yields a positive figure of 23.00 CDF. All these indicators support our premise that beekeeping is an income-generating activity for beekeepers and serves as the foundation for economic development for beekeeping operators (beekeepers).

The Net Income / Total Cost ratio shows that every Congolese Franc invested in beekeeping generates 45.67

CDF annually for the beekeeper.

❖ Other Results from Previous Studies Align with the Present Financial Analysis:

These results are similar to those found by Bakenga et al. (2015). Among the findings, it was observed that, while promoting increasingly significant agricultural yields due to the pollinating effect of bees, income derived from beekeeping alone contributes at least 60% of the total income of the agricultural households involved. Not only does it help address basic and social needs of these households (children's schooling, food, access to healthcare, etc.), but it also ensures their autonomy and financial stability, as it is also allocated as startup capital for other income-generating activities (setting up small shops, acquiring new fields, access to quality agricultural inputs and products, etc.) to diversify the financial resources of said households under village conditions.

Nininahazwe and Ndayishimiye (2014) reached similar conclusions in their value chain analysis of honey in the Rugombo commune in Burundi. They found that honey producers in the Rugombo commune achieve a higher profit margin than other actors in the chain, with an average net margin of 2,857.2 BIF per kg of honey. This same study showed that the profitability ratios of all actors in the honey sector value chain are positive, indicating that these actors generate profits.

Regarding the distribution of value added, PADERCA (2008) showed that honey producers obtain on average the largest share of the value added generated by the honey value chain in Casamance, Senegal. Per liter of honey, producers in this region capture approximately 31% of the value added generated by the entire value chain.

Our results are also reinforced by those of Lawali Sitou in 2020 in Benin, who found that income from honey sales is very substantial and averages around 114,862 FCFA/year per beekeeper and per village. Despite this significant contribution to the household economy, beekeeping faces major hurdles, including a lack of support from partners, lack of organization among beekeepers, and the absence of an adequate management plan. The performance analysis conducted in that study shows that all honey value chains are financially profitable, with a total value added ranging between 1,298 and 3,154 FCFA per liter of honey. Thus, honey production is profitable for value chain actors and for the nation as a whole, according to the author.

A. Allocation of Honey Revenues and Satisfaction of Beekeepers' Needs

100% of survey respondents view beekeeping as a major response to food and schooling challenges, 29% maintain that beekeeping allows them to save for the future, and 5% stated that beekeeping is an activity that enables them to acquire certain beekeeping equipment and materials.

YO Tiemoko et al. (2017) found that in Benin, beekeeping—practiced in various forms—presents an opportunity for diversifying and improving the income of rural populations.

B. Factors Favoring the Emergence of the Beekeeping Sector in the Study Area

The factors that were examined in relation to beekeeping in our study area:

➤ *Seniority in Beekeeping:*

In the areas covered by this study, the seniority of beekeepers ranges from 1 to 50 years. As shown in the table below, nearly 30% of the surveyed beekeepers have between 1 and 5 years of experience, reflecting a significant presence of new entrants in the sector. Conversely, about 21% have more than 20 years of experience, illustrating the long-term establishment of a segment of beekeepers.

➤ *Training Prior to Starting Beekeeping Activity:*

70.5% of beekeepers did not receive training in

beekeeping prior to joining the sector, and only 29.5% reported having received some form of training or awareness raising from development NGOs and non-profits, notably APIKIVU, whose beneficiaries were contacted during the surveys (Table). Beekeeping training and mentorship are activities that contribute to building the skills and knowledge required to master honey production.

➤ *Land Area Used for Beekeeping:*

Beekeeping in the two study groupings is mostly practiced on small land areas. 50.5% of beekeepers practice on areas of at most one hectare; 39.3% practice on areas ranging from 1 to 5 hectares; 8.2% practice on areas between 5 and 10 hectares; and only 1 farmer reported using more than 15 hectares for their beekeeping operation (Table).

➤ *Land Ownership of Exploited Lands:*

50% of beekeepers do not hold land ownership rights over the land used for beekeeping activities. They access land through temporary leasing. This situation creates substantial uncertainty for tenants, who reported frequently being victims of summary eviction by landowners, making the development of beekeeping activities difficult. However, rental prices remain very affordable according to many beekeepers, with an average annual rent of 41,541.23 CDF and a maximum annual rent of 150,000 CDF (Table).

➤ *Types of Hives Used by Beekeepers:*

The total number of hives installed by the surveyed beekeepers is 3,484 hives, including 3,441 traditional hives, 40 Kenyan top-bar hives, and 3 other unspecified hives. A significant gap is observed, not only between the types of hives used...

➤ *Hive Colonization Rate:*

Traditional hives have a colonization rate of 62.1%, Kenyan hives have a colonization rate of 82.5%, and Langstroth hives have a 0% colonization rate.

➤ *Constraints to the Development of Honey Value Chains:*

Several constraints hinder the development of honey value chains in Izege and Kaniola. They are summarized below:

Table 20 Constraints to the Development of Honey Value Chains

No.	Constraints
1	Low mastery of production techniques
2	Weak producer organization
3	Difficulties in sourcing beekeeping equipment on the national market
4	Low investment capacity of producers
5	Destruction of hives and melliferous vegetation by transhumant livestock
6	Deforestation leading to the reduction of melliferous resources
7	Bushfires leading to the destruction of apiaries
8	Theft of honey at the apiary
9	Difficulties in managing bee predators (snakes, ants, termites, and mice)
10	Irregular rainfall due to climate variability
11	Non-exploitation of hive products other than honey
12	Lack of financial services tailored to the needs of beekeepers

C. Opportunities for Improving Honey Value Chains

Assets within the honey value chains include:

- The existence of strong agro-ecological potential for beekeeping;
- The possibility of exporting honey to neighboring towns and sub-regional countries;
- The potential to diversify hive-derived products;
- Strong national and international demand for honey.

V. CONCLUSION

This work has allowed for the study of certain physicochemical parameters of honeys from IZEGE and KANIOLA, as no research had previously been conducted on these honeys, and this study yielded satisfying results.

Physicochemical analyses performed on the various honey samples—including density, pH, moisture content, total sugar content, electrical conductivity, and ash content—show that overall, these honeys meet international standards. These local honey samples comply with the quality standards recommended by the Codex Alimentarius and the EU.

This study represents a starting point for quality control of honey produced by our local beekeepers. It is recommended to institute systematic quality control of honey prior to marketing to ensure its authenticity, preserve its nutritional and therapeutic benefits, and later establish reference standards and labels for honeys from IZEGE and KANIOLA. Future consideration should also be given to analyzing Hydroxymethylfurfural (HMF) content and diastase activity, which are frequently influenced by thermal processing and storage duration.

Determining specific sugar spectra, sucrose levels, and the sum of fructose and glucose contents should also be recommended to verify honey authenticity and detect sugar adulteration.

The analysis of beekeeping's contribution to income generation for beekeepers' households allowed us to evaluate the financial performance of beekeeping in the Izege and Kaniola groupings. Beekeepers in these regions achieve a positive margin through beekeeping production activities.

The economic profitability analysis indicates that the honey value chain is profitable. With an overall turnover of 217,601,173.85 CDF for the entire sector and intermediate consumption of 4,662,000 Congolese Francs, an overall value added of 214,295,173.85 CDF is generated, with a Value Added to Intermediate Consumption ratio of 46.38 CDF and a positive Net Income to Total Cost ratio of 45.67 CDF.

The analysis of honey revenue allocation and the fulfillment of beekeepers' needs enabled us to establish a link between beekeeping and household well-being among beekeepers. Beekeeping is an essential source of income for meeting household needs, particularly regarding access to food, children's education, savings, and the acquisition of small beekeeping equipment. 100% of survey respondents

view beekeeping as a major response to food and schooling challenges, 29% maintain that beekeeping allows them to save for the future, and 5% stated that beekeeping enables them to acquire certain beekeeping equipment and materials.

The analysis of factors favoring the emergence of the beekeeping sector in the study area identified key factors for beekeeper success, notably seniority in beekeeping, training prior to starting beekeeping activity, land area used for beekeeping, land ownership of exploited lands, types of hives used by beekeepers, and hive colonization rates.

However, the emergence of the sector is hampered by several challenges, including low mastery of production techniques, weak producer organization, difficulties in sourcing beekeeping equipment on the national market, low investment capacity of producers, destruction of hives and melliferous vegetation by transhumant livestock, deforestation leading to a decline in melliferous resources, bushfires resulting in the destruction of apiaries, honey theft at the apiary, difficulties in managing bee predators, irregular rainfall due to climate variability, non-exploitation of hive products other than honey, and a lack of financing tailored to the needs of beekeepers.

Despite these challenges, the sector presents several opportunities for improving honey value chains, namely: the existence of strong agro-ecological potential for beekeeping; the possibility of exporting honey to neighboring towns and sub-regional countries; the potential to diversify hive products; and strong national and international demand for honey.

Beekeeping must be made a priority sector to combat poverty, economic dependence, and food insecurity in the groupings of KANIOLA and ISEGE in particular, and across the WALUNGU territory in general, in the South Kivu Province (DR Congo).

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ANNEXES

➤ Data Collection Questionnaire for Beekeepers

• General Information on the Respondent

Q1. Grouping (*Groupe*): 1 = Izege, 2 = Kaniola

Q2. Village: Village Name: _____

Q3. Sex: 1 = Male, 2 = Female

Q4. Age: Indicate age: _____

Q5. Number of individuals per household: Indicate the number of persons:

Q6. Level of education: 1 = University, 2 = Secondary, 3 = Primary, 4 = Other training

Q7. Main activity: 1 = Beekeeping, 2 = Agriculture, 3 = Trade/Business, 4 = Crafts, 5 = Civil Servant, 6 = Other

Q8. Secondary activities: 1 = Beekeeping, 2 = Agriculture, 3 = Trade/Business, 4 = Crafts, 5 = Civil Servant, 6 = Other

Q9. Distance between your residence and your apiary: 1 = 0 to 5 km, 2 = 5 to 10 km, 3 = 10 to 20 km, 4 = More than 20 km

• Beekeeping Practices

Q10. Roles in the beekeeping value chain: 1 = Production, 2 = Packaging, 3 = Consumption, 4 = Sales, 5 = Beekeeping Training, 6 = Other

Q11. Participation in a reforestation project with melliferous plants: 0 = No, 1 = Yes

Q12. Attacks by bee predators: 0 = No, 1 = Yes

Q13. Importance of bees in the environment: 1 = Pollination, 2 = Protection against certain diseases, 3 = Other

• Honey Production

Q14. Seniority in beekeeping: Indicate number of years: _____

Q15. Training prior to starting the activity: 0 = No, 1 = Yes

Q16. Land area used for beekeeping: 1 = 0 to 1 ha, 2 = 1 to 5 ha, 3 = 5 to 10 ha, 4 = 10 to 15 ha, 5 = More than 15 ha

Q17. Land ownership: 0 = No, 1 = Yes

Q18. Land rental (if not owner): Indicate the amount paid annually for rent: _____

Q19. Number of hives: Indicate the number of hives:

- ✓ Traditional:
- ✓ Kenyan:
- ✓ Langstroth:
- ✓ Other:

Q20. Number of colonized hives: Indicate the number of colonized hives (by type):

Q21. Types of labor used: 1 = Family labor, 2 = Hired labor

Q22. Number of paid workers: Indicate the number: _____

Q23. Monthly wage of permanent staff: Indicate the amount (in _____ francs):

. Number of harvests per year: 1 = One harvest, 2 = Two harvests, 3 = Three harvests

Q25. Liters of honey produced per hive: Indicate the number: _____

Q26. Total quantity of honey produced per year: 1 = 1 to 5 L, 2 = 5 to 10 L, 3 = 10 to 20 L, 4 = 20 to 30 L, 5 = 30 L and more

Q27. Quantity of honey consumed by the family: 1 = 1 to 5%, 2 = 5 to 10%, 3 = 10 to 20%, 4 = 20 to 30%, 5 = 30% and more

Q28. Use of hive products: 1 = Food, 2 = Sales, 3 = Therapeutics, 4 = Cosmetics, 5 = Other

Q29. Products made from honey: 1 = Medicines, 2 = Beverages, 3 = Pastries, 4 = Food products, 5 = Soaps, 6 = Ointments, 7 = Other

Q30. Barriers to increasing production: 1 = Lack of melliferous plants, 2 = Limited market, 3 = Deforestation, 4 = Bee diseases, 5 = Administrative hurdles/harassment, 6 = Lack of land, 7 = Other

- *Association Life and Access to Services*

Q31. Beekeeping training centers in the region: 0 = No, 1 = Yes Q32. Membership in a beekeepers' association: 0 = No, 1 = Yes

Q33. Partner support: 0 = No, 1 = Yes

Q34. Access to credit for beekeeping activities: 0 = No, 1 = Yes

Q35. Source of financing for credit: 1 = VSLA (AVEC), 2 = Farmers' organizations, 3 = Microfinance cooperatives, 4 = Banks, 5 = Other

- *Commercial Exchanges / Trade*

Q36. Contracts with clients: 0 = No, 1 = Yes

Q37. Type of contracts: 1 = Verbal, 2 = Written, 3 = Pre-financing, 4 = Other

Q38. Form of marketing: 1 = Raw honey, 2 = Filtered honey, 3 = Filtered and labeled honey, 4 = Other

Q39. Quantity of honey sold per year: 1 = 1 to 5 L, 2 = 5 to 10 L, 3 = 10 to 20 L, 4 = 20 to 30 L, 5 = 30 L and more

Q40. Quantity of honey exported: 1 = 1 to 5 L, 2 = 5 to 10 L, 3 = 10 to 20 L, 4 = 20 to 30 L, 5 = 30 L and more

Q41. Types of clients: 1 = Consumers, 2 = Wholesale traders,

3 = Retail traders, 4 = Pharmacies, 5 = Cosmetics manufacturers, 6 = Traditional healers, 7 = Exporters, 8 = Other

Q42. Investment in beekeeping equipment:

List the main equipment used and their purchase cost (in Congolese Francs):

- ✓ Hives: _____
- ✓ Honey extractors: _____
- ✓ Hive tool: _____
- ✓ Honey filter: _____
- ✓ Smoker: _____
- ✓ Other: _____

Q43. Estimated annual expenses:

List expenses related to honey production, including fixed and variable costs:

- ✓ Hired labor: _____
- ✓ Hive maintenance cost: _____
- ✓ Land rental cost (if applicable): _____
- ✓ Training or consultation cost: _____
- ✓ Other production costs: _____

Q44. Annual revenue:

Indicate the income generated by the sale of hive products (in Congolese Francs):

1. Raw honey: _____
- ✓ Filtered honey: _____
- ✓ Beeswax: _____
- ✓ Other products (propolis, royal jelly, etc.): _____

- *Well-Being of Beekeeping Households*

Q45. Impact of beekeeping on well-being: 1 = Children's schooling, 2 = Food, 3 = Housing, 4 = Savings, 5 = Purchase of beekeeping equipment, 6 = Other

Q46. Perception of social status in the community: 1 = Poor, 2 = Fairly good, 3 = Good

- *Profitability and Performance Assessment*

Q47. Annual net income generated by beekeeping activity:

What is the estimated annual net income from your beekeeping activity? (Total sales revenue – Production costs) = _____

(in Congolese Francs)

Q48. Profitability per hive:

- *Estimate the net profit generated per hive (in Congolese Francs) per year:*

- ✓ Less than 20,000 FC
- ✓ From 20,000 FC to 50,000 FC
- ✓ From 50,000 FC to 100,000 FC

- ✓ More than 100,000 FC

Q49. Profitability improvement:

What measures do you plan to take to improve the profitability of your beekeeping activity? Increase honey production

- ✓ Diversify products (wax, propolis, royal jelly, etc.)
- ✓ Reduce production costs
- ✓ Increase sales in new markets
- ✓ Improve honey quality (filtering, packaging, etc.)
- ✓ Other (specify): _____

• *Access to Profitable Markets*

Q50. Average selling price of honey:

What is the average selling price of honey in your area (in Congolese Francs per liter)?

- ✓ Less than 10,000 FC
- ✓ From 15,000 to 20,000 FC
- ✓ From 20,000 to 25,000 FC
- ✓ More than 25,000 FC

Q51. Main target market for honey:

Local market (village or neighboring area)

- ✓ Regional market (city of Bukavu, Goma)
- ✓ Export to other provinces
- ✓ International export
- ✓ Other (specify): _____

Q52. Honey price fluctuations:

Have you observed significant variations in honey selling prices over recent years?

- ✓ Yes, prices have dropped sharply.
- ✓ Yes, prices have increased.
- ✓ No, prices have remained constant.

• *Challenges and Opportunities*

Q53. Obstacles to the expansion of beekeeping activity:

What are the main obstacles to expanding your beekeeping activity?

- ✓ Lack of access to financing
- ✓ Lack of technical training
- ✓ High cost of beekeeping equipment
- ✓ Lack of institutional support
- ✓ Limited access to markets
- ✓ Production-related issues (diseases, lack of hives, etc.)
- ✓ Other (specify): _____

Q54. Growth opportunities in the beekeeping sector:

What are the main opportunities you see for developing your beekeeping activity in the future? Access to new markets

- ✓ Increasing sales of derivative products (wax, propolis, etc.)