FEED THE FUTURE RWANDA HANGA AKAZI ACTIVITY

BEEKEEPING VALUE CHAIN LANDSCAPE ANALAYSIS IN RWANDA

Submitted by: Anna MUGABO

Submitted to: Feed the Future Rwanda Hanga Akazi activity.

DATE OF SUBMISSION: 25th October 2023

DISCLAIMER

THIS REPORT WAS MADE POSSIBLE THANKS TO THE SUPPORT PROVIDED BY THE U.S. AGENCY FOR INTERNATIONAL DEVELOPMENT, AS PART OF CONTRACT NO 72069622C00001. THE VIEWS EXPRESSED HERE ARE THOSE OF THE AUTHORS AND DO NOT NECESSARILY REFLECT THE VIEWS OF THE UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

Contents

Contents i
List of acronyms iii
Table iv
Executive Summary 5
Chapter one: General Introduction 9
1.1 Background and context 9
1.2 Rationale and context of the beekeeping value chain analysis 10
1.3 Project description and scope 11
1.4 Objectives of the survey 12
1.5 The expected outcome of the survey 12
1.6 Methodology 13
1.6.1 Stakeholders consultations 13
1.6.2 Secondary data analysis 16
1.6.3 Primary Data collection 17
1.7 International Benchmarking Best practices 17
Chapter Two: Honey Market Global Analysis 18
2.1 World Natural Honey Production 18
2.1 World Imports of Honey 20
2.2 World Export of Honey 22
Chapter three: Rwanda's Honey Value Chain: Trade, Production, and Productivity 24
3.1. Introduction honey market in Rwanda 24
3.2 Imports and Export Trends 26
3.3 Honey production and Productivity in Rwanda 26
3.5 Productivity of Bee Hives in Rwanda 28
3.6 Cost benefit analysis of traditional, KTB and Langstroth hives 29
3.7 Honey Average income 31
3.8 Processing of Honey in Rwanda 31
3.9 Mapping of the Honey Value Chain Job opportunities 32
3.8.1. Inputs suppliers 33
3.8.2 Producers (beekeepers) 33
3.8.3 Marketing 33
3.8.4 Bulkers 35
3.8.5 Processors 35
3.8.6 Transporters 36

3.9 Capital and Access to Finance of Beekeeping Value Chain in Rwanda 36
3.9.1 Financial Services and Opportunities 36
3.9.2 Access to finance and capital 38
3.10 Estimated job creation opportunities in Apiculture 39
Chapter Four: SWOT Analysis for the Honey Value Chain in Rwanda 42
4.1 Strength 42
4.2 Weaknesses 44
- **4.3 Opportunities** 46
4.4 Threats 46
Chapter five: Specific information, Analysis and Insights on beekeeping in the selected and sampled districts 48
5.1 Introduction 48
5.2 Identified opportunities and services in sampled districts 48
5.3 Beekeeping equipment supply in selected Districts 49
5.4 Additional other challenges identified in three selected Districts 51
5.5 Beekeeping special SWOT Analysis of selected Districts 54
5.5.1 SWOT Analysis in Kamonyi 55
5.5.2 SWOT Analysis in Gatsibo District 56
5.5.3 SWOT Analysis in Nyabihu District 57
5.6 Conclusion and Recommendations 57
Chapter Six: Beekeeping Best practices 60
6.1 Good beekeeping practices 60
6.1.1 Factors influencing the quality honey production 61
6.1.2 The main pillars for sustainable beekeeping 62
6.1.3 Harvesting and handling for quality 63
6.1.4 Pillars for help beekeepers in rural areas 66
ANNEXES: 68
Annex 1: List of consulted stakeholders 68
Annex II: Beekeeping Sector Business Opportunities 69
LIST OF BEEKEEPING COOPERATIVES AND COMPANIES 70

List of acronyms

CAGR	: Compound Annual Growth Rate
EDP	: Entrepreneurship Development Policy
EU	: European Union
FAO	: Agriculture Organization
FDA	: Rwanda Food and Drugs Authority
FIs	: Financial Institutions
FRW	: Rwandan Francs
HA	: Hanga Akazi
KTB	: Kenya Top Bar Hive
KTBH	: Kenya Top Bar Hive
MIFOTRA	: Ministry of Public Service and Labour
MINAGRI	: Ministry of Agriculture and Animal Ressources
MINICOM	: Ministry of Trade and Industry
MINIYOUTH	: Ministry of Youth
MT	: Mass Tons
NCPD	: National Council of Persons
NST1	: National Strategy for Transformation
NWC	: National Women Council
NYC	: National Youth Council,
PSF	: Private Sector Federation
PSTA4	: Rwanda Strategic Plan for Agriculture Transformation
RDB	: Rwanda Development Board,
REMA	: Rwanda Environment Management
RICA	: Rwanda Inspectorate, Competition and Consumer Protection Authority
RSB	: Rwanda Standards Board
RTI	: Research Triangle Institute
SDG	: Sustainable development goals
SNV	: Netherlands Development Organisation
USA	: United States of America

Table

Table 1: World Natural Honey production 2019-2021 (1000 Metric Tons) 19
Table 2: World Imports of Honey (in quantity and value)..... 21
Table 3: World Exports of Honey (in Quantity and Value) 22
Table 4: Rwanda Export and Import Trade data for Natural honey, value in Rwf..... 26
Table 5: Production Capacities of different hives against the estimated optimal potentials..... 28
Table 6: Honey cost benefit analysis..... 29
Table 7: Honey Average income to farmers 31
Table 8: Estimating the income and total jobs for adding 5,000 tons of honey in Rwanda 40

Figure

Figure 1: World Natural Honey production 2000-2021 (1000 Metric Tons).....18
Figure 2: Share of imports of honey for year 2020 and year 2022 (in percentage share) 22
Figure 3: Rwanda Honey Value Chain 32
Figure 4: Kamonyi Honey VC SWOT Analysis 55
Figure 5: Gatsibo VC SWOT Analysis.....56
Figure 6: Nyabihu VC SWOT Analysis 57

Executive Summary

RTI International is leading the charge in implementing the "Feed the Future Rwanda Hanga Akazi" initiative, a concerted effort aimed at bolstering employment prospects and entrepreneurial achievements in Rwanda. This initiative places a strong focus on empowering marginalized groups, particularly women, youth, and individuals with disabilities, within the agricultural sector. It endeavors to cultivate not only technical but also essential soft skills, fostering inclusive enterprises, and envisions the transformation of the livelihoods of 23,000 job seekers, while simultaneously stimulating the creation of 19,000 jobs through collaboration with strategic partner firms.

The "Feed the Future Rwanda Hanga Akazi" initiative is specifically designed to uplift skill levels and encourage employment, with a special emphasis on women, youth, and individuals with disabilities, throughout the entire honey value chain. As part of this comprehensive initiative, an extensive landscape analysis of beekeeping in Rwanda was meticulously conducted across three key provinces, namely Eastern, Southern, and Western, over a period of 23 working days. This comprehensive analysis serves as a crucial repository of knowledge, offering insights into beekeeping practices, the intricacies of the value chain, stakeholder dynamics, prevailing challenges, existing policies, and valuable lessons drawn from successful international models.

The landscape analysis has been a discerning exercise, bringing to light both opportunities and challenges within the beekeeping industry. It offers a panoramic view of beekeeping practices, the value chain, stakeholder engagements, and policy landscape. Additionally, it leverages insights from global best practices to magnify the sector's untapped potential. This comprehensive analysis equips stakeholders with priceless insights to make informed decisions, paving the way for the sustainable development of beekeeping in Rwanda. Furthermore, the analysis dives deep into the feasibility of job creation, exploring avenues for expansion, and evaluating new market opportunities, including exports and diversification into various bee-related products.

The foundation of this extensive analysis lies in a variety of research methods, encompassing desk reviews, illuminating key informant interviews, insightful questionnaires, and direct observations of beekeepers. Specific data was collected from stakeholders in three vital districts: Kamonyi, Gatsibo, and Nyabihu. These interviews encapsulate discussions with district officials, private sector federations, and companies deeply entrenched in the beekeeping value chain.

These interviews have illuminated the vast potential within the sector, revealing opportunities ranging from nursery preparation to the production of cost-effective inputs for beekeepers, such as hive construction, bee suits, gloves, bee smokers, and boots.

Additionally, it highlights commercial prospects in colony multiplication, queen rearing, bee health laboratories, Api tourist sites, training, monitoring, quality control, the construction of honey collection centers (HCCs), storage and equipment facilities, mobile honey collection units, transport solutions, and an array of honey value-added products. These opportunities offer a remarkable avenue for job creation, particularly for youth, women, and individuals with disabilities. The beekeeping value chain also presents diverse prospects in the supply of equipment, accessories, materials, training equipment, honey extraction, processing, packaging, branding, marketing, sales, and exports.

Moreover, this report draws attention to the astounding growth of the global honey market, which has skyrocketed from USD 1.7 billion in 2011 to an impressive USD 8.53 billion in 2022. This remarkable expansion can be attributed to the growing recognition of the health benefits of honey, which witnessed a significant surge in demand during the COVID-19 pandemic.

Rwanda's honey exports have been steadily rising, with estimations of 5300 tons of honey generating USD 1.5 million and 300 tons of bee wax contributing USD 1.4 million. In 2021, Rwanda emerged as the 100th largest exporter of honey globally, with exports worth $0.9 million in 2022. Notably, honey ranked as the 333rd most exported product in Rwanda in 2021, with key destinations including Singapore, the United Arab Emirates, the Democratic Republic of the Congo, Oman, and Saudi Arabia. The fastest-growing export markets for Rwandan honey between 2020 and 2021 were the United Arab Emirates, the Democratic Republic of the Congo, and Singapore.

Bees play a pivotal role in maintaining ecosystems and agriculture, making their conservation and sustainable management a global priority. Rwanda's natural forests, abundant in wild plant resources and home to disease-resistant wild bees, produce honey from unique pesticide-free flora. Additionally, the country's wealth of eucalyptus trees yields a distinct and highly sought-after variety of honey.

A SWOT analysis conducted on the beekeeping value chain in select districts, such as Kamonyi, Nyabihu, and Gatsibo, has revealed a multitude of opportunities, ranging from hive construction to honey sales, and even beekeeping tourism.

However, despite the significant potential of the beekeeping industry to generate job opportunities and income, it faces certain challenges. A significant portion of beekeepers still rely on traditional methods and equipment, resulting in lower incomes compared to modern hives. For instance, the income from a single traditional hive can range from 54,000 Rwandan francs to 126,000 Rwandan francs per year, while modern hives can generate an annual income of 800,000 Rwandan francs.

The assignment has unveiled a thriving sector comprising 200,000 dedicated beekeeping farmers collectively managing 650,000 hives, making a substantial contribution to the economy, with an estimated annual income of approximately 19.25 billion Rwandan francs. Key stakeholders in the honey value chain include government institutions such as the Ministry of Agriculture and affiliated organizations, the Ministry of Commerce, the Ministry of Public Service and Labour, as well as non-governmental organizations like World Vision, AVIS, and SNV.

The value chain predominantly consists of many producers who act as their own processors, supplying honey directly to retailers and end users. This method often results in lower-quality honey due to outdated and conventional techniques employed by many honey farmers. Additionally, elderly individuals with limited knowledge of modern beekeeping practices predominantly occupy the sector. The honey value chain offers a wide range of products, including wax, pollen; propolis, royal jelly, and venom, each with numerous therapeutic applications, but beekeepers often lack the knowledge to exploit these opportunities.

The increasing import and export of honey in Rwanda emphasize the need for value addition to meet international standards.

In conclusion, beekeeping in Rwanda presents a promising avenue for job opportunities, income generation, and economic development. By proactively addressing challenges and capitalizing on abundant opportunities, Rwanda can nurture a resilient and sustainable honey industry while championing inclusivity and environmental conservation. The preservation of honeybee populations and the invaluable ecosystem services they provide hinge upon the promotion of sustainable beekeeping practices.

.
The assessment and final consultations have proposed the following recommendations to be implemented by concerned stakeholders:

- Provide intensive training to all relevant actors on beekeeping management and beehive installation, among other skills.
- Provide Comprehensive training programs focusing on both traditional and modern beekeeping methods.
- Support on standards implementation and operationalization Strict Regulations
- Continuous engagement with beekeepers through mobilization campaigns is essential for fostering commitment and sustainability.
- Initiatives supporting start-ups, including hive and bee purchases and raise awareness about beekeeping as an area that can generate jobs.
- Advocate to limit or control the use of pesticides for the survival of bees : conduct awareness campaigns on the impact of pesticides on beekeeping, importance of biodiversity,
- Encourage beekeepers to explore value-added products to optimize income.
- Encourage evening pesticide spraying to minimize impact on bee activity.
- Advocate for government support in providing designated areas for hive placement.

- Promote experienced elders' knowledge transfer to mentor young beekeepers.
- Establish collection centers in every sector for ease of honey distribution.
- Seek investors interested in beekeeping and honey production.
- Promote sustainability in beekeeping practices, including eco-friendly hive placement.
- Improve the quality production of the smallholder beekeepers
- Strengthening climate resilient extension services for beekeepers (production, harvesting)
- Strengthening access to inputs (adequate beehives, tools)
- Strengthening research (bee health, bee genetics, climate resilience)
- Increase plantation of melliferous trees and plants
- Strengthening producer organisations and cooperatives in governance and service delivery to their members
- Advocate for creating buffer zones or designated areas for beekeeping activities.
- Establish honey collection centers for better quality assurance.
- Raise awareness about forest preservation among people in forested areas.
- Engage relevant stakeholders in skills enhancement like RTB for a beekeeping curriculum development and adoption of teh course in technical schools.

Chapter one: General Introduction

1.1 Background and context

The COVID-19 pandemic has had an unprecedented and shocking impact on the world, and demand for honey has increased more than expected in all regions compared to pre-pandemic levels. Future forecasts predict continued high demand for dietary products that promote immunity and are healthy. On the other side, consumers are becoming more inclined to choose sugar replacements, particularly natural sweeteners. One of the main causes is a rise in the number of diabetics, obese people, and those with high cholesterol who are continuously looking for healthier alternatives to sugar. Honey is becoming increasingly popular throughout the world because of its antiviral, antifungal, and antibacterial effects.

The demand for organic products has increased notably in the last few years, especially in the developed markets of Europe, the USA, and Asia. The high profits associated with organic products and their high demand among environmentally friendly and health-conscious consumers drive the growth of natural products. The application of the honey product in innovative health drinks and supplements is emerging as one of the most popular market trends across several economies.

There are market segments for local customers with lower incomes, national consumers with medium to high incomes who live primarily in cities, regional consumers across, International foreign consumers from the EU, and consumers from the United Arab Emirates. Table honey typically finds its way to the neighborhood market, where it is available in a variety of packaging and brands.

In Rwanda, as well as across the globe, the significance of bees in fostering sustainable livelihoods is widely acknowledged and cherished. Bees represent a remarkable global asset due to their pivotal role in pollinating flowering plants, thus serving as essential contributors to our ecosystem. Their invaluable contribution extends to bolstering agriculture through the pollination of crops, leading to enhanced seed and fruit yields. Albert Einstein once emphasized that the absence of honeybees from the planet would result in human extinction within a mere four years, underscoring the critical role bees play in human survival.

Beekeeping is an integral component of agriculture, rural development, and national economic development and plays a critical role in conservation of ecosystems.
Bees are a barometer of the health of natural ecosystems, pollinators of forests, horticultural and agricultural and they are also kept for their marketable products. Such products include honey, which is used for both food and medicinal purposes. it has been demonstrated that beekeeping has the capacity of improving crop yields many times over for cranberry farmers.

While honey is the most immediately recognizable bee product, the realm of beekeeping encompasses a realm far beyond this sweet substance. Beekeeping yields a myriad of benefits, with the maintenance of biodiversity and the pollination of flowering plants standing out as the paramount services offered by bees. Honey, although notable, represents just one facet of the multitude of products derived from beekeeping, including wax, pollen, propolis, royal jelly, and venom, many of which hold therapeutic applications. This diverse range of products holds the potential to generate employment opportunities, particularly for youth, women, and person with disabilities.

The nexus of bees and beekeeping significantly contributes to people's livelihoods. Throughout human societies, honey and other bee products have held a steadfast presence. The utilization of bee species, their associated uses, and beekeeping techniques exhibit substantial variation across different regions. Although the depletion of wild bee colonies is increasingly rare in Rwanda, traditional beekeeping traditions persist, gradually evolving into a modern practice that engages individuals highly skilled in apiculture. This transition not only provides livelihoods but also creates avenues for youth and women to secure gainful employment.

1.2 Rationale and context of the beekeeping value chain analysis

Due to its therapeutic and nutritional benefits, honey is the primary bee product consumed worldwide. In 2021, the market for honey in the world was worth USD 8.17 billion, and in 2022, it was worth USD 8.53 billion, noting that in 2011 World Honey market was worth 1.7 billion dollars. The global market grew by 9% in 2020 compared to 2019, and it is anticipated to reach $12.69 billion by 2029, with an anticipated overall growth rate raging between 6% throughout the forecast period of 2023–2029[1], the total revenue is projected to expand at a rate of 11%, reaching around US$ 30.69 billion.

According to the statistics from the National Institute of Statistics, Rwanda's natural honey imports have almost tripled from FRW 513,036,436 in 2016 to FRW 1,455,237,360 in 2022, while exports of natural honey increased from FRW 9,691,919 in 2016 to FRW 929,133,376 in 2022. It is estimated that 5300 tons of honey is exported, generating USD 1.5Million, Bee wax 300 generating USD 1.4 million. While recognizing the significant growth potential within the honey industry, it becomes evident that there is a pressing need to enhance the value proposition of honey through improved packaging and product diversification. Presently, honey is valued at just USD 5 per kilogram, considerably lower than the international standard of USD 10 per kilogram.

[1] https://www.fortunebusinessinsights.com/industry-reports/honey-market-100551

Thus, it is imperative for Rwanda Honey to fortify its value addition efforts to align with global expectations. By thoroughly assessing the entire honey value chain, including product diversification and the promotion of green jobs within a circular economy framework, beekeeping emerges as a substantial source for job creation and a catalyst for achieving international competitiveness.

The RTI International is executing the Feed the Future Rwanda Hanga Akazi initiative to tackle the challenge of inadequate employment prospects and limited entrepreneurial achievements among Rwandans, which detrimentally affect both the Rwandan economy and the nation's developmental objectives. The Hanga Akazi (HA) initiative aims to facilitate the enhancement of skillsets for Rwandans, with a particular focus on women, youth, and individuals with disabilities.

These skillsets encompass both technical and soft skills essential for active participation in a contemporary workforce, primarily within the agricultural sector. Furthermore, the initiative serves as a catalyst for the emergence and expansion of inclusive enterprises.

Throughout the duration of the Feed the Future Rwanda Hanga Akazi initiative, interventions is geared towards aiding a minimum of 23,000 job seekers in accessing improved or novel employment opportunities. Concurrently, the initiative's support for agribusinesses targets to the generation of at least 19,000 jobs within partner firms.

1.3 Project description and scope

The survey was conducted in three districts of the following provinces in Rwanda: Eastern (Gatsibo), Southern (Kamonyi), and Western (Nyabihu). This comprehensive effort took place over a span of 23 workdays. The selection of districts was done based on the information obtained from RDB of registered cooperatives.

The objective of conducting a landscape analysis of beekeeping in Rwanda is to gather in-depth information and insights regarding the present status of beekeeping in the nation. This collected information served as a foundation for identifying potential opportunities to foster growth and advancement within Rwanda's beekeeping industry. The analysis offers a holistic overview of existing beekeeping practices, the beekeeping value chain, key stakeholders involved, challenges confronting beekeepers, as well as the prevailing policies and regulations governing beekeeping in Rwanda. Moreover, the analysis spotlights exemplary practices and successful beekeeping models from other nations, which can be tailored and implemented in Rwanda to enhance the beekeeping sector.

This landscape analysis proves invaluable to the HA Activity and other vested stakeholders within the beekeeping realm. These stakeholders encompass the private sector, non-governmental organizations, and beekeepers themselves.

Armed with this comprehensive analysis, these entities can make well-informed decisions pertaining to investments, policies, and strategic interventions, all aimed at fostering the sustainable development of beekeeping in Rwanda.

1.4 Objectives of the survey

The scope of work for a consultant to analyze the beekeeping landscape in Rwanda would typically include the following:

1. Researching the beekeeping industry: The consultant would research the beekeeping industry to gain an understanding of the current state of the industry, its challenges, and opportunities.
2. Identifying key stakeholders/ actors: The consultant would identify the key stakeholders and actors in the beekeeping landscape, including beekeepers, honey processors, and distributors in Rwanda.
3. Analyzing the beekeeping landscape: The consultant would analyze the honey farming landscape to identify the current trends, challenges, and opportunities for the industry. This analysis would include an assessment of the current and potential demand for honey and related products, as well as an evaluation of the competition in Rwandan market.
4. Assessing the feasibility and opportunities of beekeeping value chain for job creation: The consultant assessed the feasibility and opportunities for job creation in the beekeeping value chain particularly for youth, women and persons with disabilities.
5. Evaluate the potential for expanding the beekeeping industry in Rwanda, including the identification of new market opportunities, such as the export market, and the potential for diversification into other bee products.
6. Developing recommendations: Based on the analysis and assessment, the consultant would develop recommendations for beekeeping interventions that would promote job creation at different level of the values chain practices, the best practices for beekeeping, and the most effective marketing and distribution strategies in Rwandan market.
7. Providing a report: The consultant would provide a comprehensive report summarizing the analysis, assessment, and recommendations. The report would include a detailed description of the honey farming landscape, the potential beekeeping sites identified, and the feasibility of job creation, as well as a detailed analysis of the current state of the honey farming industry and its prospects.

1.5 The expected outcome of the survey

The following deliverables were delivered by the consultant:

- Inception report detailing the methodology, approach, and action plan to execute the assignment
- The draft finding report analysing the beekeeping landscape in Rwanda
- Final report after integrating all inputs and comments from concerned stakeholders.

1.6 Methodology

Conducting a holistic analysis of the beekeeping value chain in Rwanda entails a multifaceted approach. The methodology encompasses comprehensive and extensive desk review, key informant interviews, questionnaires, and observations of bee farmers.

During the data collection, we had the privilege of interviewing key stakeholders involved in beekeeping and honey production cooperatives, individuals, companies, and cooperative unions in three districts: Kamonyi, Gatsibo, and Nyabihu District. The stakeholders mentioned below provided valuable insights into the sector, employment opportunities in the beekeeping sector, challenges, and recommendations.

In all three districts, at least seven key informant interviews were conducted based on these components; hive construction, beekeeping equipment supply, beekeeping training and extension services, honey extraction and processing, packaging and branding, marketing and sales, exports and others. They included district officials, private sector federations, and companies or cooperatives involved in beekeeping value chain businesses.

1.6.1 Stakeholders consultations

Key stakeholders, consulted include; the Ministry of Agriculture, MINICOM, MIFOTRA, Rwanda Development Board, REMA, Ministry of Youth, National Youth Council, National Women Council, MGEPROF, Financial Institutions, NCPD, and the Private Sector Federation, have been actively engaged in collaborative efforts to promote the growth and sustainability of the beekeeping and honey value chain in Rwanda. This comprehensive approach ensures that all relevant parties are aligned to achieve common goals.

The Ministry of Agriculture takes a lead role in overseeing apiculture and works closely with the Rwanda Agriculture Board to drive economic growth while also prioritizing environmental stewardship. Meanwhile, the Ministry of Youth, National Council of Persons with Disabilities, and National Union of Disability Organizations of Rwanda have been consulted due to their potential involvement in fostering active participation in apiculture, thereby promoting inclusivity and empowerment.

MIFOTRA plays a crucial role in facilitating employment opportunities, particularly for youth and individuals with disabilities, while MINICOM and the Private Sector

Federation create a conducive environment for the growth of apicultural enterprises. These stakeholders are instrumental in providing market access, regulatory support, and investment stimulation within the sector.

Furthermore, engagement with the Food and Agriculture Organization (FAO) brings a global perspective into the initiative, ensuring the integration of best practices from around the world into local strategies. The FAO and similar organizations offer invaluable technical expertise, resources, and insights drawn from their international experiences, enriching the overall approach to beekeeping development.

The consultant conducted a thorough review of documents and sought input from a wide array of stakeholders within the beekeeping industry, including non-governmental organizations, cooperatives, and beekeepers themselves. This collaborative approach ensured that decisions regarding investments, policies, and interventions were well-informed and tailored to support the sustainable growth of beekeeping in Rwanda.

For the entire apiculture value chain to thrive, collaboration is of paramount importance. Beekeepers, associations, processors, and sellers constitute the core of this chain, and their synchronized efforts are instrumental in shaping the sector's trajectory. The involvement of agronomists, apiary leaders, and the Business Development Unit adds a crucial layer of expertise. The stakeholders, including the Ministry of Agriculture, MINICOM, MIFOTRA, Rwanda Development Board, REMA, Ministry of Youth, National Youth Council, National Women Council, MGEPROF, Financial Institutions, NCPD, and the Private Sector Federation, have been actively engaged in collaborative efforts to promote the growth and sustainability of the beekeeping and honey value chain in Rwanda. This comprehensive approach ensures that all relevant parties are aligned to achieve common goals.

The Ministry of Agriculture takes a lead role in overseeing apiculture and works closely with the Rwanda Agriculture Board to drive economic growth while also prioritizing environmental stewardship. Meanwhile, the Ministry of Youth, National Council of Persons with Disabilities, and National Union of Disability Organizations of Rwanda have been consulted due to their potential involvement in fostering active participation in apiculture, thereby promoting inclusivity and empowerment.

REMA engages communities in the conservation and maintaining forests as well as certification of honey packaging. Other institutions for quality control and supervision include RICA, RSB and FDA.
MIFOTRA plays a crucial role in facilitating employment opportunities, particularly for youth and individuals with disabilities, while MINICOM and the Private Sector Federation create a conducive environment for the growth of apicultural enterprises. These stakeholders are instrumental in providing market access, regulatory support, and investment stimulation within the sector.

Furthermore, engagement with the Food and Agriculture Organization (FAO) brings a global perspective into the initiative, ensuring the integration of best practices from around the world into local strategies. The FAO and similar organizations offer invaluable technical expertise, resources, and insights drawn from their international experiences, enriching the overall approach to beekeeping development.

The consultant conducted a thorough review of documents and sought input from a wide array of stakeholders within the beekeeping industry, including non-governmental organizations, cooperatives, and beekeepers themselves. This collaborative approach ensured that decisions regarding investments, policies, and interventions were well-informed and tailored to support the sustainable growth of beekeeping in Rwanda.

The significance of cooperatives cannot be overstated. By fostering collaboration and shared resources, these entities can magnify the impact of individual beekeepers and associations. Moreover, establishing connections with consumers, buyers, and exporters facilitates a seamless flow of high-quality products into the market.

This collaborative effort culminates in a robust honey market value chain that holds promise for economic growth, employment generation, and empowerment. However, it's important to acknowledge that challenges undoubtedly lie ahead, encompassing barriers to market access and technical hurdles.

The apiculture sector in Rwanda has the potential to drive holistic development by embracing diverse demographics and interests. The integration of ministries, organizations, entities, and stakeholders creates a harmonious convergence of efforts aligned with the objective of inclusive growth. By addressing challenges and nurturing opportunities, these collaborative endeavors can yield a promising future for Rwanda, akin to the sweetness of honey. By strategically integrating diverse sources and methods, the study endeavors to provide a holistic and well-informed perspective on the details of beekeeping practices in Rwanda.

In this assignment, the analysis aims to identify the best practices and successful beekeeping models from other countries. These can then be adapted and implemented in Rwanda to enhance the beekeeping industry. The landscape analysis provides valuable insights for HA Activity and various stakeholders in the beekeeping sector.
This includes the private sector, non-governmental organizations, and beekeepers, enabling them to make well-informed decisions regarding investments, policies, and interventions. These efforts collectively contribute to the sustainable development of beekeeping in Rwanda.

1.6.2 Secondary data analysis

The research commenced with an exhaustive search and collection of secondary sources. These documents and report encompass a wide range of materials, including academic literature, research reports and publications, government publications, international databases, and online resources. All these helped to amass a diverse set of information that provides a foundational understanding of beekeeping on global scale and in particular in Rwanda.

To enhance the breadth and depth of the dataset, supplementary materials from reputable international journals, relevant publications, and accessible resources were incorporated. This amalgamation bolstered the existing understanding, bringing diverse perspectives and insights to the forefront.

During the Desk review, the following documents were reviewed:
Policy documents, regulations and other relevant documents;

- Sustainable development goals (SDG)
- National Strategy for Transformation (NST1)
- PSTA4 Rwanda Strategic Plan for Agriculture Transformation
- National Agriculture Policy
- Leveraging Private Sector Strategy
- FAO Good beekeeping practices for sustainable apiculture
- Developing Community based tourism, GIZ report, 2021.
- Beekeeping/ honey Value chain financing study report. NV report May 2009
- Entrepreneurship Development Policy (EDP)
- Good bee keeping practices: practical manual on how to identify and control main diseases of the Honeybee (Aps mellifera). TECA publication, 2018.
- NISR-National Institute of Statistics of Rwanda Labour force Survey2018, 2022.
- African Organic; agriculture Training manual 2018.
- International articles on honey landscaping economic, social, and structural factors constraining inclusive job growth and creation for decent employment in Rwanda

Beekeeping Institutions (RAB, MINAGRI, MINICOM, MINYOUTH, MEJEPROF, RFA, RSB, NIRDA, NWC, NYC, NCPD, RAF, NAEB)

Supplementary Information from Selected Provinces and Districts for data collection was conducted:

- Southern Province: No change needed.
- Eastern Province (Gatsibo):
- Western Province (Nyabihu):
- Districts selected were based on information obtained from the Rwanda Development Board (RDB) of registered beekeepers.

This supplementary information provides a comprehensive overview of the data collection process in selected provinces and districts.

The data collected in these areas will be instrumental in addressing our research objectives and providing valuable insights into the status of beekeeping, employment opportunities, challenges and recommendations.

1.6.3 Primary Data collection

The primary data mostly qualitative data were collected through key informant interview and field observations that have helped to gather real-time perspectives, experiences, and practices. The primary data collection provided a nuanced understanding of the details, SWOT Analysis, Costs and prices and challenges faced by those involved in beekeeping.

1.7 International Benchmarking Best practices

FAO has compiled the best practices on sustainable apiculture and good knowledge on the proper management of bees to optimize the natural systems and resources beekeepers rely on. Specifically, knowledge of state-of-the-art technologies and innovations to increase productivity. Future perspectives and innovations in modern beekeeping such as precision farming, innovative traceability systems, bee data standardization and blockchain technologies.

Many books have researched into the daily lives of domestic honeybees, but the untold story of coexistence between their wild counterparts and cousins remained in the shadows. In "The Lives of Bees," Professor Thomas Seeley, a renowned expert in honeybee biology, provides a captivating glimpse into the existence of wild honeybee colonies beyond the scope of conventional beekeeping practices. The book appeals not only to beekeepers but also to biologists intrigued by the dynamics of feral honeybee communities.

This consultancy involves in-depth research to enrich honey farmers with comprehensive insights into bee management, challenges, and future prospects. Engaging local beekeepers is pivotal to grasping the hurdles and opportunities faced by various groups, including youth, women, and individuals with disabilities. Drawing inspiration from Kayuki's sentiments on the potential of beekeeping (New Times, 30th May 2013), the study aims to quantify the yield from traditional beehives versus modern ones, assessing parameters such as quality, quantity, and potential youth employment.

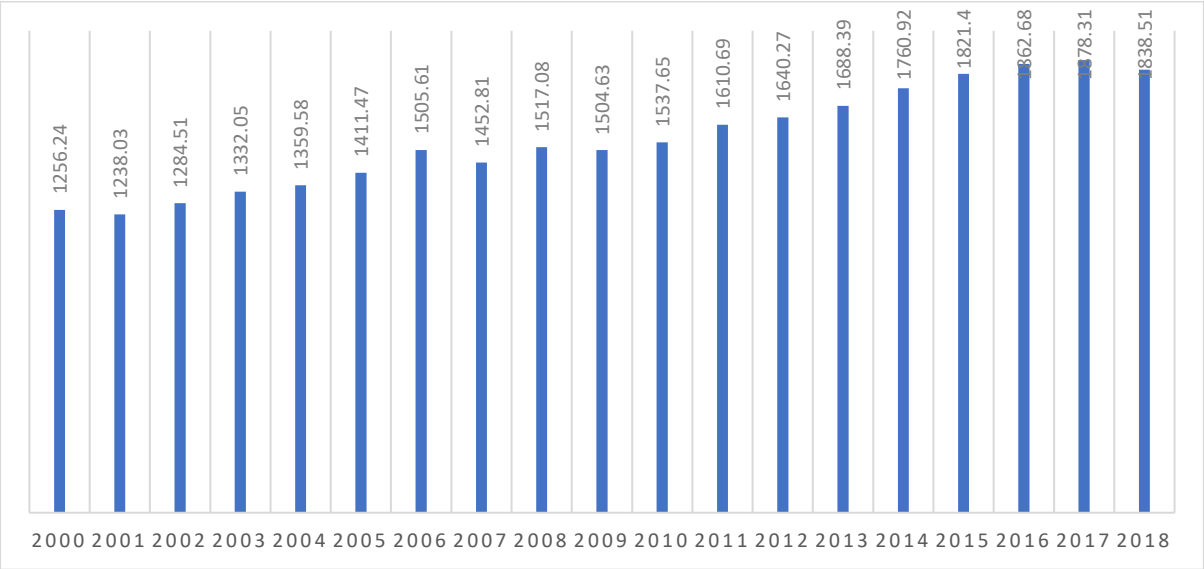
Chapter Two: Honey Market Global Analysis

The global honey market was worth USD 8.17 billion in 2021 and USD 8.53 billion in 2022, up from USD 1.7 billion in 2011. The production volume of natural honey worldwide increased from 1.25 million metric tons in 2000 to 1.77 million metric tons in 2021[2].

2.1 World Natural Honey Production

According to the table below, the average annual production of honey worldwide was about 1.77 million metric tons in 2021. In 2020, there will be about 94 million beehives in the world, up from about 80 million beehives in 2010. The global production volume of honey peaked in 2017 at about 1.88 million metric tons and has since decreased to about 1.77 million metric tons.

Figure 1: World Natural Honey production 2000-2021 (1000 Metric Tons)



Source: UN Report 2022

The increasing demand for honey, beeswax, and other byproducts in developing countries is expected to boost the global market in the upcoming few years.

[2] Fortune Business Insights, https://www.fortunebusinessinsights.com, retrieved in September 2023.

Europe and North America have a significant consumption share of products like propolis, honey, and other products, while rapid growth has been observed in the Asia-Pacific regions. Support for organic agriculture has been rising, and this trend has led to a rise in pollination demand, which boosts the apiculture market.

The table below indicates the share of honey production, with China being the first country, followed by the European Union, Turkey in third place, and Iran in fourth place.

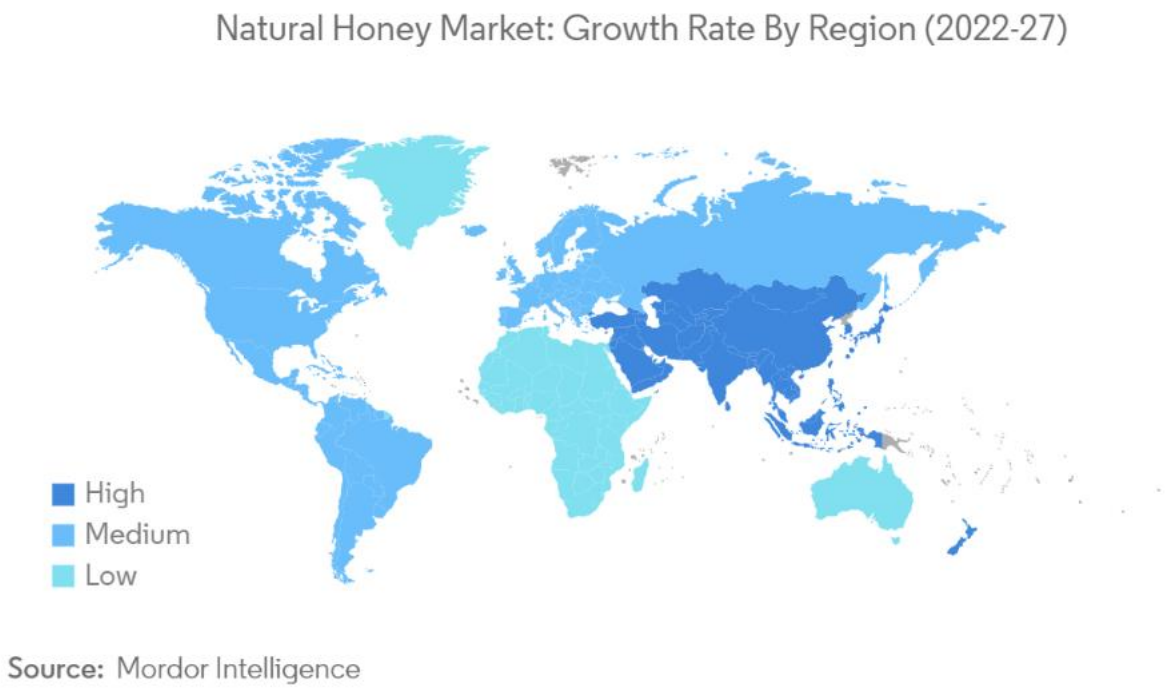
Table 1: World Natural Honey production 2019-2021 (1000 Metric Tons)

Country	**2019**	2020	***Share of World Production***
China	444	**458**	*26%*
EU	226	218	*12%*
Turkey	109	104	*6%*
Iran	78	**80**	*5%*
Argentina	79	**74**	*4%*
Ukraine	70	**68**	*4%*
USA	71	**67**	*4%*
Russia	64	**66**	*4%*
India	62	**62**	*4%*
Mexico	62	**54**	*3%*
Brazil	46	**52**	*3%*
Canada	39	**38**	*2%*
Tanzania	31	**31**	*2%*
Republic of Korea	30	**29**	*2%*
New Zealand	23	**27**	*2%*
Angola	23	**24**	*1%*
Viet Nam	22	**22**	*1%*
Uruguay	20	**20**	*1%*
Kenya	14	**18**	*1%*
Central African Republic	16	**17**	*1%*
Uzbekistan	13	**13**	*1%*
Ethiopia	15	**13**	*1%*
Australia	13	**13**	*1%*
Other	196	202	*11%*
Total	**766**	**770**	

Source : FAO, 2020

Over 35.0% of revenue was generated in Europe in 2022, and it is anticipated that this region would continue to lead during the projected period.

A quickly strengthening economy brought on by increasing disposable income, urbanization, and changing lifestyles is anticipated to fuel product demand in the area and boost market growth overall in the years to come. From 2023 to 2030, Asia Pacific is anticipated to have the greatest Compound Annual Growth Rate (CAGR). Consumers' rising preference for scrumptious and healthy eating routines is accelerating industry growth.



As it can be depicted by the world map above, the world's largest market for natural honey is recorded to be in Asia-Pacific. China produces and consumes the most honey in the Asia-Pacific region, followed by India. The increase in domestic natural honey production can be attributed to China's huge land, abundant nectar source, massive population, and rising standard of life. In China, honey is a common food that is easier to find in a grocery than sugar. With a population of more than 1.4 billion people in 2020, China used more than 300,000 metric tons of honey annually.

2.1 World Imports of Honey

The global market is being driven by the general public's rising health consciousness. People are looking for healthier alternatives to refined sugars and artificial sweeteners as they grow more health-conscious. Honey is viewed as a healthier alternative due to its natural combination of carbohydrates, vitamins, minerals, and antioxidants. Additionally, the development of the beekeeping industry is significantly accelerating market growth. Additionally, the market's prospects are being helped by consumers' increased preference for niche foods, which is fueling an increase in the demand for uncommon forms of honey.

Additionally, more products are being sold all over the world as a result of the simplicity with which they may be accessed through organized retail platforms, both online and offline.

From a continental perspective, buyers in European countries imported the highest dollar worth of natural honey with purchases totaling $1.31 billion or 47.4% of the global total. In second place were importers in North America at 30.9% while another 18.4% of all natural honey imports was delivered to Asia.
Smaller percentages were sold to customers in Oceania (1.5%) led by Australia, Africa (1.47%), then Latin America (0.3%) excluding Mexico but including the Caribbean.

Table 2: World Imports of Honey (in quantity and value)

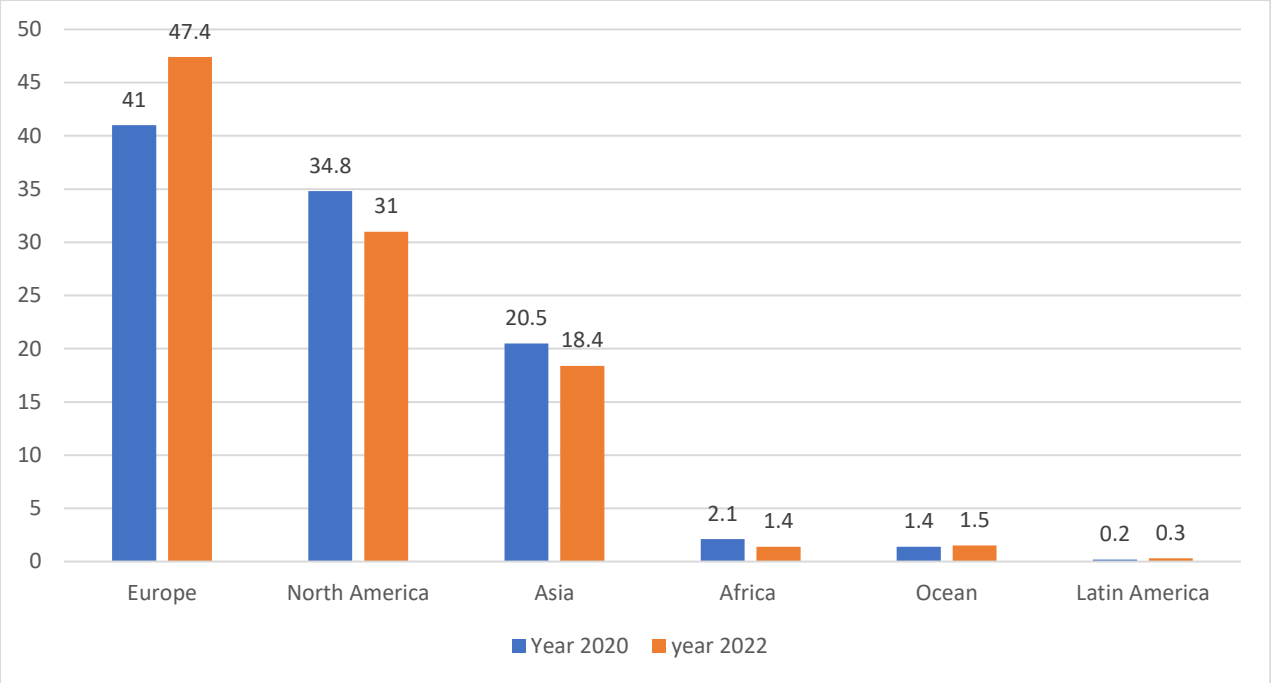
	2019		**2020**		**Share of World Imports**	
	Tons	1 000 €	Tons	1 000 €	Tons	1 000 €
European Union	167,097	355,283	174,885	359,939	29.90%	24.70%
North America	195,452	414,995	203,843	414,545	34.80%	28.50%
Of which USA	188,882	384,142	196,641	386,424	33.60%	26.60%
Asia	72,010	295,406	80,468	314,658	13.70%	21.60%
of which Japan	44,788	129,058	49,348	152,043	8.40%	10.40%
China	4,962	75,812	4,272	78,102	0.70%	5.40%
Other European Countries	59,767	142,034	64,897	152,692	11.10%	10.50%
Near and Middle Eastern Countries	33,803	122,558	39,655	153,400	6.80%	10.50%
Africa	11,856	20,121	12,097	20,330	2.10%	1.40%
Oceania and Polar Regions	4,838	34,027	7,992	36,015	1.40%	2.50%
South America	349	858	927	2,310	0.20%	0.20%
Central America and Caribbean's	791	2,212	546	1,512	0.10%	0.10%
Total	545,963	1,387,494	585,310	1,455,401		

Source : UN Report, 2021

The top 15 countries that spent the most on imported natural honey in 2022. United States: US$794.3 million (28.8% of natural honey imports) Germany: $302.2 million (11%) Japan: $168.9 million (6.1%); France: $140.3 million (5.1%) United Kingdom: $127.6 million (4.6%); Italy: $106.2 million (3.9%); Belgium: $102.5 million (3.7%); Spain: $89.6 million (3.3%); Poland: $71.7 million (2.6%); China: $71.4 million (2.6%); Netherlands: $65.3 million (2.4%) Saudi Arabia: $62.3 million (2.3%); Canada: $56.9 million (2.1%); Switzerland: $45.8 million (1.7%); and Australia: $39.3 million (1.4%). And among the above countries, the fastest-growing markets for natural honey since 2021 were: Canada (up 50.1%), Belgium (up 19.9%), the United States of America (up 18.8%), and France (up 16.1%).

Major suppliers that posted declines in their imported natural honey purchases were led by: mainland China (down 32.2% from 2021), Saudi Arabia (down 27.7%), Poland (down 21.5%), and Germany (down 4%).

Figure 2: Share of imports of honey for year 2020 and year 2022 (in percentage share)



Rapid urbanization, substantial developments in the food and beverage (F&B) industry, rising disposable incomes, and extensive research and development (R&D) initiatives carried out by several top players are other factors that have an impact on the market's growth.

2.2 World Export of Honey

Table 3: World Exports of Honey (in Quantity and Value)

	2019		**2020**		**Share of world imports**	
	Tons	**1 000 €**	**Tons**	**1 000 €**	**Tons**	**1 000 €**
Asia	213,413	388 997	211,330	379 238	40.10%	26.20%
of which China	120,832	210 136	132,441	222 333	25.10%	15.40%
South America	105,614	213 593	128,020	253 779	*24.30%*	17.50%
Other European Countries	68,992	147 275	95,244	175 575	18.10%	12.10%
European Union	27,432	144 259	31,439	63 775	*6.00%*	11.30%

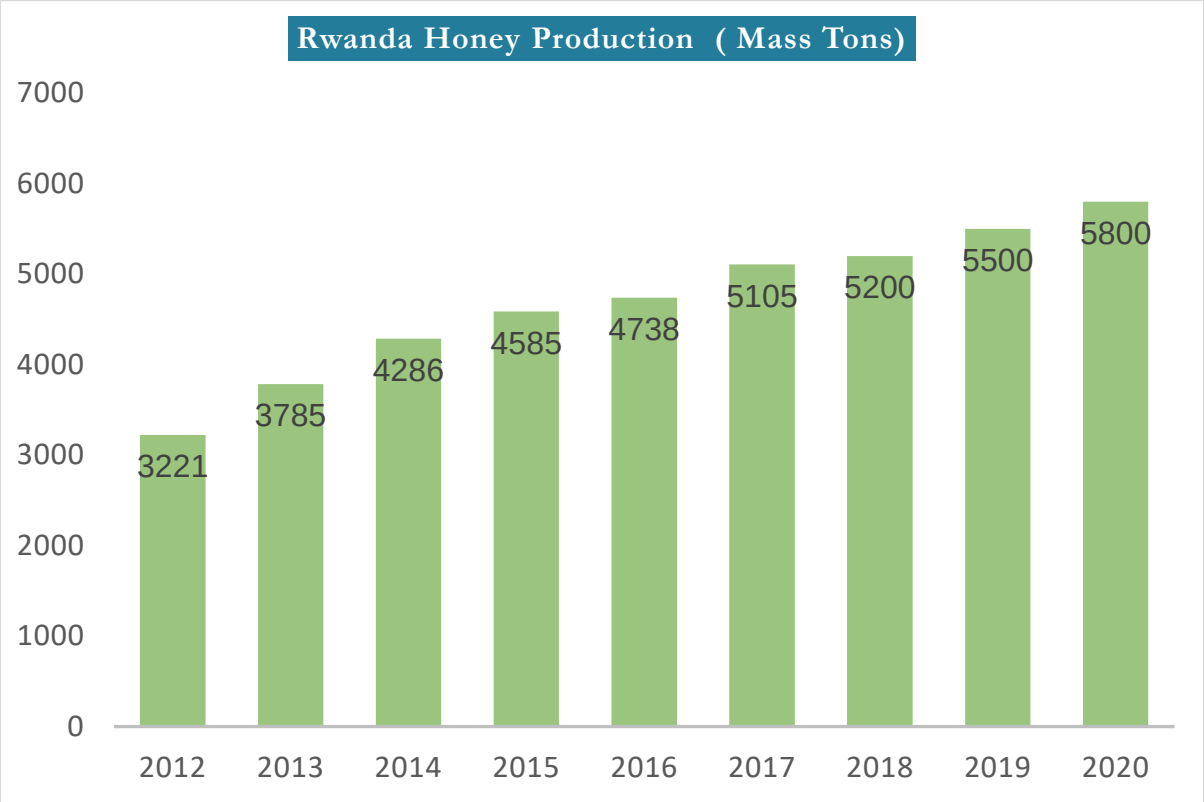
	2019		2020		Share of world imports	
Central America and Carribeans	28,643	64 932	18,592	61,193	*3.50%*	4.20%
North America	19,816	57,660	17,884	53,886	3.40%	3.70%
of which Canada	12,082	36,897	9,426	31,368	1.80%	2.20%
USA	7,734	20,762	8,458	22,518	1.60%	1.60%
Oceania and Polar Regions	12,227	238,061	16,775	322,690	3.20%	22.30%
Near and Middle Eastern Countries	8,999	38,379	4,695	25,758	0.90%	1.80%
Africa	4,910	11,409	3,417	11,619	0.60%	0.80%
Total	490,045	1,304,563	527,397	1,447,515		

Source : UN Report 2020

Chapter three: Rwanda's Honey Value Chain: Trade, Production, and Productivity

3.1. Introduction honey market in Rwanda

Beekeeping has steadily become important in Rwanda due to the growing domestic and international markets.



Source: Rwanda Beekeeping strategy 2022-2032

The trend above shows concerted efforts of major institutional and legislative frameworks put in place to organize Rwanda's long-term development for the honey industry. Mostly propolis, beeswax, and honey are produced in Rwanda. The great natural ecological elements of Rwanda are a major reason why Rwandan bee products have a promising future.

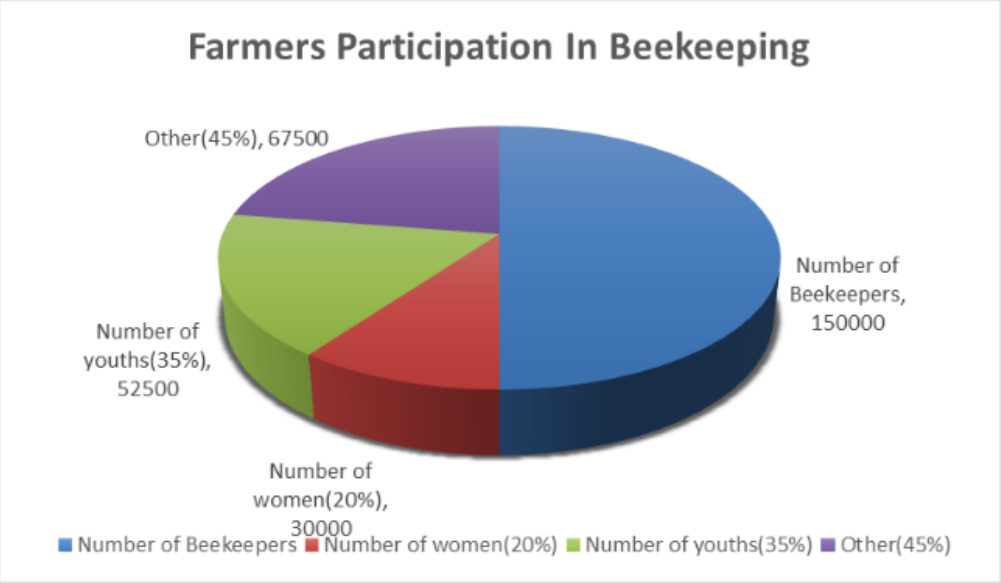
The natural forests in Rwanda, which are rich in wild plant resources and home to healthy wild bees that are disease-resistant, create honey manufactured from unique pesticide-free flora. The country's large number of eucalyptus trees also provide a unique and well-liked variety of honey. The Rwandan honey industry is struggling to expand its capacity due to the country's high demand for honey. Especially on the export market, honey has a high market value. Consumers who are concerned about their health are more aware of its healing abilities. It is used as a food preservative and to manufacture a range of confections.

According to MINAGRI's 2009 beekeeping sector recommendations, apiculture primarily comprises five economic sectors in Rwanda: economic development, environmental conservation, food security, agriculture, and animal development. It offers a lot of potential for human and economic growth, including lowering poverty. Through the pollination of melliferous plants, apiculture helps maintain sustainable environmental conditions by protecting and increasing the forest cover, which is estimated to be 20%, and by protecting against deforestation.

The existence of a thriving agriculture sector, which primarily supplies food for Rwanda's population, is essential for maintaining a healthy and stable environment. In Rwanda, beekeeping has been a traditional practice for many generations. It plays a vital role in the livelihoods of rural communities in various ways: The existence of a thriving agriculture sector, which primarily supplies food for Rwanda's population, is necessary for a healthy and stable environment. In Rwanda, beekeeping has been practiced for many generations. It is essential to rural communities :

- Around 200,000 farmers are engaged in the beekeeping in the country (Beekeeping RDS 2022-2032) with a total of 650.000 hives.
- Beekeeping, as estimated in the Beekeeping RDS 2022-2032, generates an annual income of approximately 19.25 billion francs.
- Beyond its economic significance, the medicinal properties of honey and various hive products are invaluable.
- Beekeeping plays a pivotal role in supporting agriculture by aiding essential processes such as cross-pollination, ultimately enhancing crop and seed yields.
- It contributes significantly to forest conservation efforts and fosters healthy benefits within biodiversity.

The following table shows famers participation in beekeeping in Rwanda.



Source: Rwanda beekeeping Development Strategy 2022-2032

3.2 Imports and Export Trends

The following table indicates the Natural Honey both export and imports from 2016 to 2022.

Table 4: Rwanda Export and Import Trade data for Natural honey, value in Rwf

Flow	2016	2017	2018	2019	2020	2021	2022
Import	513,036,436	976,949,974	1,017,199,527	1,257,201,390	1,054,089,709	1,077,059,180	1,455,237,360
Export	9,691,919	51,299,429	41,410,915	13,363,159	35,279,336	54,482,839	929,133,376
Re-export		187,548	1,019,338	561,766	110,924	1,605,929	6,967,334

Source: NISR, 2022

The honey imports from abroad to Rwanda have steadily increased from 2016 and almost tripled in 2022 as the value of the imports increased from Frw 513 million in 2016 to Frw1.4 billion in 2022. In 2021, Rwanda imported $1.07 Million in Honey, becoming the 80th largest importer of Honey in the world. At the same year, Honey was the 341st most imported product in Rwanda. Rwanda imports Honey primarily from: Tanzania ($1.06M), Belgium ($3.48k), Germany ($854), Netherlands ($646), and South Africa ($474). The fastest growing import markets in Honey for Rwanda between 2020 and 2022 were Tanzania ($378k), France ($272), and South Africa ($149) as per the data of 2021 from the OEC[3] - The Observatory of Economic Complexity.

3.3 Honey production and Productivity in Rwanda

Input providers, beekeepers, bulkers, processors, transporters (who also double as dealers), processors, exporters, wholesalers, retailers, and consumers are the primary participants in the honey value chain in Rwanda. The bulk of participants in the honey value chain are micro and small players at the production and commerce levels, and the chain is still mostly unstructured. The value chain is still quite integrated, with many producers acting as their own processors and providing to retailers and end users. However, the honey sold through this method is of lower quality.

[3] https://rb.gy/wrdsf

Most honey farmers still produce below their potential using crude, conventional techniques. Similar to this, because of insufficient amounts supplied by the farmers, processors are processing at or below capacity. Since the majority of producers either process the honey or deliver it straight to the larger processors, their function as middlemen is very minor.

The major flaws in the honey value chain are low honey quality and inadequate supply levels brought on by ineffective production and processing techniques. With only two enterprises providing packaging jars, the honey inputs sub-sector is underdeveloped and has an inadequate supply of the same.

There is a chance for new investment here. Traditional, KTB, and Langstroth bee hives are the three basic types sold on the market. The input providers only offer a little amount of extension and after-sales support. With the exception of diabetics, honey is the second-most favored sweetener in families for beverages after sugar. As honey combs or as a spread over toast, it is also eaten uncooked. Additionally, it is utilized to make wine and liquor. Women predominate in temporary jobs during the honey trading era.

Value capture - Wholesalers and retailers buy combed and liquid honey at the same prices although they each capture different gross margins from their respective markets. Analysis of the gross margins along the honey value chain indicated that all factors held constant, trade in liquid honey is most profitable at the wholesaling stage, and least profitable at the processing stage.

The markets for other bee-products are still underdeveloped and this provides potential for expanding end-markets for the honey sub-sector. Most of these products, which include propolis, venom, and wax, are underexploited, in spite of available end-markets and proven technologies to utilize them.

The weakest links in the honey sub-sector are those between producer organizations and individual producers, producer organizations and processors, middlemen and processors/producers and processors and exporters. Due to low yields, most producers and/or processors fail to meet the demand for honey. Weak linkages between the processors and the export market are as a result of processors failing to meet standards and the quality set by the international market.

Because most producers and processors are able to single-handedly perform most functions along the value chain, their linkages with the middlemen is weak.

Strong linkages along the chain are noted between local artisans and producers, producers and retailers and processors and retailers. The linkages between local artisans and producers are strong because of the ability of the artisans to locally duplicate modern hives (KTB and Lang stroth) and make them available at an affordable price.

3.5 Productivity of Bee Hives in Rwanda

The productivity of different hives varies and is dependent on the type of hive used as well as the management practices applied. According to MINAGRI report 2022, there are 6500,00 hives in the country.

The current productivities of traditional, KTB, and langstroth are 5.6 kg/hive/Season, 10kg/hive/Season and 14 kg/hive/Season while their potential productivities are 15 kg/hive/Season, 26 kg/hive/Season and 60 kg/hive/Season respectively. Based on the difference between the current productivities and the potential productivities, the yield gaps of the three hives were 25%, 23%, and 53%, respectively (SNV, 2009).

Table 5: Production Capacities of different hives against the estimated optimal potentials

Type of Hive	Average Production (kgs)/Season	Seasons/Year	Optimal Production	Variance
Traditional	5.6	2	15	(25%)
KTB	10	2	26	(23%)
Langstroth	14	2	60	(53%)

Source; Value Chain Investigation, SNV Rwanda, 2009

Production is mainly through indigenous means with most farmers having the traditional log, grass and bark hives. Due to their topology, background and design characteristics, traditional hives are universally low yielding in terms of honey production which is the main verifiable indicator.

The assessment revealed that the average hive ownership per farmer in the high potential areas was 2.6. The average yield from traditional hives per season is a net of 3.5Kgs which falls short of the standard average estimate of 5.6 Kgs per season.

Although traditional bee hives have the least productivity, they are still the most preferred by majority of the bee keepers. This is attributed to their low cost, availability of local materials for making them and ease of construction and harvest.

Although beekeepers using the Langstroth hive experience the highest productivity, there is still a huge yield gap of 77% from the potential yield. Interestingly, beekeepers using the KTB hive reported the lowest yield gap of 54%. This probably is as a result of intensive training of farmers in adoption and use of the KTB. The Ministry of Agriculture and Animal Resources; Ministry of Trade and Industry, and various players in the sector like SNV have built the capacity of many farmers on how to use the higher yielding KTB.

It should be noted that the productivity of these bee hives is also dependent on: the size of the hive, siting of the hives and type of vegetation around the hives' site. These influence the strength of the bee colony and the honey yield. In addition to determining honey productivity, vegetation also affects flavor, color and viscosity of honey.

3.6 Cost benefit analysis of traditional, KTB and Langstroth hives

The table below summarizes the profitability of honey at different stages of the value chain. Farmers sell combed, semi-processed, and processed honey and earn the corresponding gross margins/kg listed below. The significance of honey value addition at the farm level to increase farmer margins is supported by the information provided during key interview conducted in sampled key informants.

The study by Samson[4] and Nepo[5] on the analysis of the profitability of honey production in Nyamagabe District in Rwanda in 2021 for a sample size of 20 beekeepers, where data on cost and revenue were collected, The gross margin analysis and cost-benefit analysis were performed to compare benefits versus investment costs. The study findings showed that the average mean of gross farm revenues is FRW 808,020 from honey bee production against the average investment cost of FRW 172,360 per household. The Benefit Cost Ratio (BCR) for beekeeping production was found to be 4.49, suggesting that the gross revenue of FRW 449 was made from an investment cost of FRW 100 in honey bee production.

Table 6: Honey cost benefit analysis

Types of Hives	Stats	Age	Education	HH size	Farm Size	Experience in beekeeping	Number of hives
Unit		Years	Years	Heads	Ha	Years	Pcs
Beekeepers owning Traditional beekeeping	Mean	50	7.833	4.833	1.77	9.667	20.667
	SE (Mean)	5.9	0.98	0.946	0.189	1.43	3.712
	SD	14	2.401	2.317	0.464	3.502	9.092
	Min	28	6	1	1.24	3	10
	Max	68	12	8	2.42	13	32
	N (Obs)	6	6	6	6	6	6
Beekeepers owning Modern bee hives	Mean	39	6.357	4.429	1.315	10.357	22.786
	SE (Mean)	2.9	0.58	0.552	0.167	1.193	2.192
	SD	11	2.17	2.065	0.627	4.465	8.201
	Min	26	3	1	0.38	3	10

[4] *Nsekanabanzi Samson, University of Rwanda, College of Agriculture, Animal Science and Veterinary Medicine, School of Agriculture and Food Science, Gikondo Campus, Rwanda*

[5] *Nsengiyumva Jean Nepo, University of Rwanda, College of Agriculture, Animal Science and Veterinary Medicine, School of Agriculture Engineering, Department of Irrigation and Drainage, Nyagatare Campus, Rwanda*

Types of Hives	Stats	Age	Education	HH size	Farm Size	Experience in beekeeping	Number of hives
	Max	60	11	8	2.5	17	36
	N (Obs)	14	14	14	14	14	14
Total of the sampled beekeepers	Mean	42	6.8	4.55	1.4515	10.15	22.15
	SE (Mean)	2.8	0.511	0.467	0.136	0.921	1.854
	SD	13	2.285	2.089	0.609	4.12	8.293
	Min	26	3	1	0.38	3	10
	Max	68	12	8	2.5	17	36
	CV	0.3	0.336	0.459	0.42	0.406	0.374
	N (Obs)	20	20	20	20	20	20

Source: Analysis of the profitability of honey production in Nyamagabe District in Rwanda, University of Rwanda, 2021

The purposive sampling was used to gather the needed information from the selected respondents. The data collected are socioeconomic features of honey producers and marketing characteristics of the honey demographic honey production per bee keeper, farm gate price, quantity sold to markets, quantity consumed at family level. Both Beekeepers owning Traditional beekeeping and Beekeepers owning Modern bee hives were included in the selected. The total cost included variable cost and fixed cost used (Bee hive, Hive Tools, Labor Smoke, Labor Extractor, Labor bee veil, Labor Uncapping knife, Stand cost and cost of Transportation of honey harvested) was estimated.

It was found that the total cost was ranging from 145,600 Frws to 208,200 Frws while on overage, the investment cost in honey bee production was found to be 172,360 Frws per households as per the above table). The gross farm revenues ranged from 369160 Frws to 1,471,107 Frws while the average mean of gross farm revenues is 808,020 Frws from honey bee production. The Net Farm Income (difference between total revenue and total cost of production) was ranging from 165160 Frws to 1,323,307 Frws while on average while the average net farm income paid to farmer after deduction is 635,660Frws Frws respectively per household producer of honey bee production and this depends on number of bee hives and types of hives (traditional or modern) owned.

During the key informant interview conducted in 2023, all beekeepers indicated that modern hives generate more income than traditional hives, with langstroth hives producing the highest, followed by KTBH with log hives producing the lowest income. The common types of pests and rodents stated by farmers are ants, mites, and beetles, and pests and predators lower the quality of honey by eating the honey and pollen, while others take lumps of soil and their droppings in the hives, which lowers the quality of honey greatly.

3.7 Honey Average income

As it can be observed, the average income from beekeepers varies according to the number and types of hives used by the farmers.

The average income per year for one hive varies from 54,000 Frw to 126,000 Frw (the price of one kilogram of honey is estimated at minimum price of 4,500 frw), depending on the type of hive. Supposing that the farmer has 10 hives of KTB, he will be able to generate an annual income of 800,000 frw, equivalent to 60,000 frw per month.

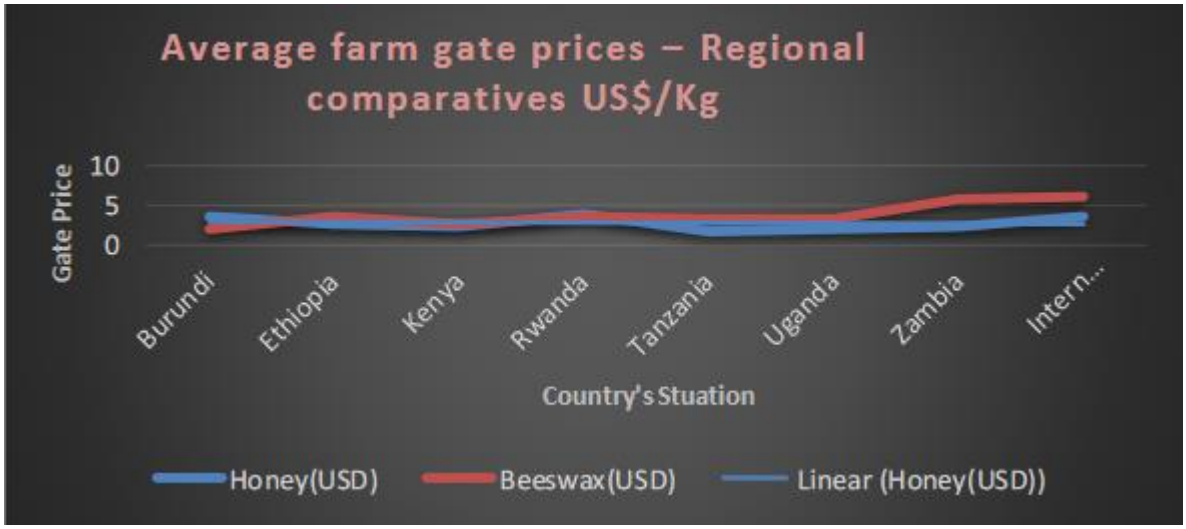
Table 7: Honey Average income to farmers

Types of Hives	Average production per hive	Optimal Production at 2 seasons per year	One hive Average income per year (4500Frw/1 kg)	Average year income for 5 Hives (Frw)	Average year income for 10 Hives (Frw)
Traditional	6	12	54,000	270,000	540,000
KTB	10	20	90,000	400,000	800,000
Longstroth	14	28	126,000	630,000	1,260,000

Source: Estimated based on data provided by farmers, 2023

It is estimated that 5300 tons of honey is exported, generating USD 1.5Million, Bee wax 300 generating USD 1.4 million. The price per kilo of honey is USD 5.

Regional comparison Of Honey/ Product Prices.



Source: Rwanda Beekeeping Development strategy 2022-2032

3.8 Processing of Honey in Rwanda

Honey Producers and small-scale traders carry out primary processing (the major processing level of Rwanda honey) and sell their honey to bigger traders.

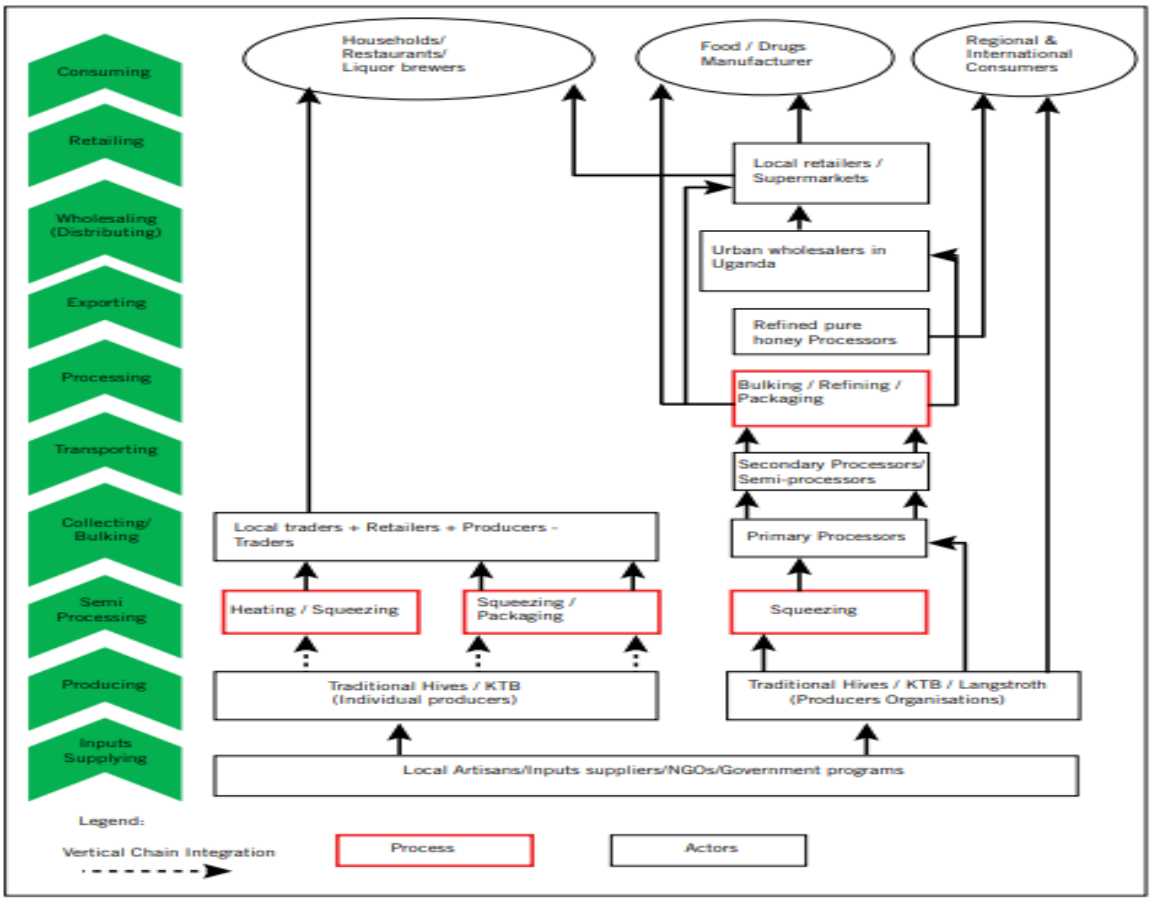
Some producers bottle their honey and sell it directly to the final consumers. Secondary processing is done in processing factories. In this case, beekeepers sell their honey to packers and processors. Once processed, the processors sell the honey to retail outlets.

- **Raw Honey Filtration:** Newly extracted honey is often full of impurities, including wax particles and sometimes bee parts. Filtering removes these impurities.
- **Pasteurization:** Some honey is heat-treated to kill potential yeast and prevent fermentation, although raw honey advocates argue this can degrade the quality and nutritional value.
- **Packaging**: After processing, honey is packaged in various forms (jars, squeeze bottles, packets) for sale.

3.9 Mapping of the Honey Value Chain Job opportunities

Figure below shows the key interrelated activities/processes that enable honey as the product to reach the final consumer right from inputs supplier. The main actors in the honey value chain are: input suppliers, bee keepers (producers), bulkers, processors, transporters who also double as traders, processors, exporters, wholesalers, retailers and consumers.

Figure 3: Rwanda Honey Value Chain



Source: UNDP Honey Analytics Report 2021.

3.8.1. Inputs suppliers

The input supplier is made up of businesses and/or individuals engaged in the production of beekeeping equipment for sale to potential producers.

There are generally two categories of input suppliers for modern KTB and langstroth hives and hive-related tools. Local artisans are based in rural areas and have acquired knowledge and skills through experience, trial, and error, although some have limited training. The other input suppliers are semi-formal establishments based mainly in City of Kigali. Their needs for financial services are limited, especially because clients who need hives are required to make down payments, which mostly cover the cost of materials and part of the labor.

The majority of the time, they purchase hives and related equipment in partnership with or under contracts from technical institutions, then sell these inputs to beekeepers. The majority of communities also had information about nearby artists who could be hired to build top-notch hives. Despite widespread knowledge of the advantages of utilizing modern hives, some independent beekeepers continue to use old hives.
There are some specialized in beekeeping's inputs, which deals specifically with bee-keeping-related inputs. These inputs include beehives (KTB and Langstroth), bee suits, honey extractors, airtight buckets, smokers, and gloves. There are also local beehive manufacturers who make the traditional hives from tree logs.

3.8.2 Producers (beekeepers)

Beekeepers set up and maintain colonies of bees. They provide the bees with hives and may move them around to access different flowering crops. These are individuals at the household level, those organized in cooperative groups, and some companies. They can be broadly divided into: a) Traditional beekeepers who use traditional beehives made from logs or pot hives) Modern bee keepers who use improved beehives, such as the KTB and Langstroth hives, sometimes in addition to traditional beehives. Beekeepers who belong to groups engage in collective production and marketing, accessing inputs, credit, and training. Beekeepers extract honey from hives periodically using various tools and methods.

3.8.3 Marketing

Beekeepers sell their honey through the following channels:

- Neighborhood market (friends, neighbors, and nearby villages);
- Local shops: bottled and labelled honey is sold directly to local shops and supermarket.

- Farmer-based cooperative: some people flock the farm to buy the honey directly from the producers.
- House to house or on the roadside: some beekeepers set up stalls which they locate in appropriate places such as the market or along a busy route; this attracts a good number of customers.
- In bulk and cooperative: some beekeepers form associations to collect and market the bee products of beekeepers in an area.

- Branding: Honey brands differentiate themselves based on origin, flavor, raw vs. processed, organic status, etc.
- Advertising: To increase sales and demand, companies might advertise their honey through various media.
- Certifications: Rwanda Standard Board inspect and verify claims about organic farming practices, purity, geographic origin, etc.

1) **Exporters:** The main destination of Honey exports from Rwanda is: European Union, Singapore; United Arab Emirates; Eastern Republic Democratic of Congo, and Saudi Arabia.

2) **Wholesalers:** Wholesaling quite often forms an integral part of the roles of the major processors who sell in bulk to the local retailers and supermarket chains.
3) **Retailers:** The major retailers dealing in honey are both local and foreign supermarket chains. Honey sold in these outlets is packaged in glass and plastic jars and bottles, they have all the accredited sign of Rwanda Standard Board.
4) **Consumers:** Honey is used in households as a preferred sweetener in beverages, especially for diabetics. It is also consumed in its raw state (honey combs) or spread on bread.
5) **Beverage and Manufacturing:** Honey is used in brewing of liquor and wine. In the food industry, honey is used as an ingredient for example in making whole wheat bread.
6) **Pharmacy and Medical purpose:** Honey is used for medicinal purposes: a) Honey has antiseptic and antibacterial properties and has been used in first aid treatment, especially for wounds, burns, and cuts, b) Traditional uses of honey include honey mixed with lemon for sore throats, and it has also been used for stomach pains, c) Honey has also been used in the cosmetics industry for making skin-care products as well as coating drugs in the pharmaceutical industry.
7) **Research & Development:** there are various research into bee health, honey production methods, and market trends.

3.8.4 Bulkers

Local intermediaries, retailers, and occasionally producers primarily engage in this process with the objective of aggregating sufficient quantities for distribution to urban consumers or liquor breweries. Some producers even purchase honey from various sources, repackage it, and market it through local retail outlets, typically handling semi-processed or liquid honey. Meanwhile, major processors play a crucial role in bulk procurement, acquiring honey from numerous individual farmers, traders, or contracted growers. These actions significantly impact the overall price of honey, with one kilogram selling for 3,500 francs, in contrast to genuine natural honey, with prices ranging from 5,000 to 10,000 francs per kilogram

3.8.5 Processors

In Rwanda, there are companies and cooperatives that have standardized processing, labeling, and packaging; there are others, such as traders and producers, who only do the extraction of liquid honey from the honeycombs. Some of the local processors include Nyabihu cooperative Union, cooperative CODA JYAMBERE and cooperative Coporomi.

Among the techniques that commercial processors can afford are:

a) **The Cold Dripping Method (CDM),** which is preferred by semi-processors. Overnight, combs are cut into pieces and filtered via a mesh or net. Repeating this might guarantee high product quality. The CDM approach is simple and affordable because it doesn't require specialized equipment. Given that there is still a significant amount of honey in the combs, honey recovery is not particularly effective. The honey produced by CDM is incredibly transparent.

b) **Pressing method:** there are two known processing methods used in processing honey, and these are:

- **Pressing method using a cloth:** This is a traditional method of extracting honey from honeycombs by manually pressing the honeycombs wrapped in a clean cloth. Honey oozes out of the cloth and into a storage bucket. Sometimes honey crystallizes while still in the honeycomb, making it challenging to extract. In such cases, the honeycomb is heated to separate the wax, which floats to the top and can be removed after cooling. These methods are not very efficient and can result in lower-quality honey, which typically fetches lower prices.
- **Pressing method using a pressing machine:** It is not commonly used due to the high cost of pressing machines. However, the yield of honey per unit volume of combs is greater compared to other methods.

3.8.6 Transporters

Companies and cooperatives hire transport for collecting honey from designated points in the areas of production. On the other hand, traders and middlemen who sell their honey to urban areas use public transport, and there is a likelihood that these honeys end up not being of the required quality and not fulfilling the required standards**.**

3.9 Capital and Access to Finance of Beekeeping Value Chain in Rwanda

Value Chain Finance (VCF) is a crucial approach for comprehending the financial requirements of participants within the beekeeping value chain. This section delves into the financial dynamics in Rwanda from three distinct angles: the demand side (to understand financial needs), the supply side (to assess existing financial service opportunities), and the disconnect side (to address gaps). By examining the financial dynamics of the beekeeping/honey sub-sector, Hanga Akazi will gather insights to devise effective interventions and sustainable strategies that encompass the entire value chain. This approach aims to fortify existing relationships and uncover potential linkages to enhance the performance of the beekeeping sub-sector.

Information provided by key stakeholders and key informant interviews indicates that in the past, multiple entities, including financial institutions, organizations, development partners, government institutions, and private entrepreneurs, offered financial services to the beekeeping value chain. However, stakeholders now report inadequacies and difficulties in accessing capital and financing, which pose significant challenges hindering the growth and development of the sector.

3.9.1 Financial Services and Opportunities

Supporting the honey value chain in Rwanda can have a positive impact on both the local economy and the livelihoods of beekeepers. Rwanda has made efforts to promote beekeeping and honey production as part of its agricultural development strategy. Here are some financial services and opportunities that can support the honey value chain in Rwanda:

- **Access to Credit:** Beekeepers and honey producers often need access to credit to invest in equipment, such as beehives and processing facilities, or to expand their beekeeping operations. Local banks and microfinance institutions can provide loans tailored to the needs of honey producers.
- **Grants and Subsidies:** The government of Rwanda or international organizations may offer grants or subsidies to support beekeeping and honey production. These funds can be used for training, purchasing equipment, or improving infrastructure.

- **Technical Assistance and Training**: Financial institutions and NGOs can collaborate to offer training programs on modern beekeeping techniques, honey harvesting, and processing. These programs can help beekeepers increase their productivity and product quality.
- **Honey Cooperatives:** Encourage the formation of honey cooperatives or associations. These organizations can provide collective bargaining power, access to markets, and financial services for their members. They can also pool resources for processing and marketing.
- **Market Access and Export Financing:** Honey producers looking to export their products may need assistance with export financing, including pre-export financing, insurance, and access to export markets. Financial institutions can provide services tailored to export needs.
- **Value Addition Financing:** Investing in value addition is crucial to increase the value of honey products. Financial services that support setting up processing units and value addition facilities can greatly benefit the honey value chain.
- **Quality Control and Certification:** Support honey producers in obtaining quality certifications, such as organic or Fair Trade certifications, which can open up premium markets. Financial institutions can assist with the costs associated with certification.
- **Infrastructure Development:** Investment in rural infrastructure, such as roads and storage facilities, can reduce post-harvest losses and improve the overall efficiency of the honey value chain.
- **Insurance:** Provide insurance products tailored to the risks faced by beekeepers, such as hive destruction due to disease or extreme weather events. Insurance can help protect their investments and income.
- **Market Information Services:** Financial institutions can collaborate with information providers to offer market intelligence and price information to honey producers, helping them make informed decisions about production and marketing.
- **E-commerce and Digital Payments:** Facilitate e-commerce platforms and digital payment systems for honey producers to expand their customer base and streamline financial transactions.
- **Investment in Research and Development:** Encourage investments in research and development to improve beekeeping practices, bee health, and honey processing technologies. Financial institutions can support research initiatives through grants or partnerships.

To access these financial services and opportunities, honey producers and value chain actors should reach out to local banks, microfinance institutions, agricultural cooperatives, government agencies, and non-governmental organizations (NGOs) that specialize in agricultural development. Collaboration among various stakeholders, including financial institutions, is essential to foster a thriving honey value chain in Rwanda.

3.9.2 Access to finance and capital

Access to finance and capital is a crucial factor in the development and sustainability of the honey value chain in Rwanda, as it is in many other agricultural sectors. Honey production and processing require various inputs, equipment, and infrastructure, all of which necessitate financial resources. Here are some key points to consider regarding access to finance and capital in the honey value chain in Rwanda:

- **Limited Access to Credit:** Many small-scale honey producers and beekeepers in Rwanda face challenges in accessing credit from formal financial institutions such as banks and credit unions. This is often due to a lack of collateral and limited financial literacy.
- **High Dependency on Informal Financing:** Due to limited access to formal credit, beekeepers and small honey processors often rely on informal sources of financing, such as savings groups, family and friends, or local moneylenders. These sources may charge high interest rates and can be unreliable.
- **Cooperatives and Associations:** Honey cooperatives and associations play a significant role in improving access to finance for beekeepers. They often facilitate collective bargaining and access to credit for their members.
- **Government Initiatives:** The Rwandan government has recognized the importance of agriculture, including beekeeping, in the country's development. They have implemented various initiatives and programs to improve access to finance for small-scale farmers, including beekeepers.
- **Microfinance Institutions:** Some microfinance institutions in Rwanda specialize in providing financial services to small-scale farmers and beekeepers. These institutions may offer loans tailored to the needs of those involved in the honey value chain.
- **Value Chain Financing:** Value chain financing involves linking various actors in the honey value chain, from producers to processors to buyers, with financial institutions. This can help streamline the flow of funds and make financing more accessible to all participants.
- **Capacity Building:** Financial literacy and business management training are essential for beekeepers and honey processors to effectively manage the funds they acquire. Capacity-building programs can improve their financial management skills.
- **Risk Mitigation:** Access to finance can be improved by implementing risk mitigation strategies. For example, the government or development organizations can offer credit guarantees or insurance schemes to encourage formal financial institutions to lend to beekeepers and honey processors.
- **Investment in Infrastructure:** Access to capital can also be improved by investing in the necessary infrastructure for honey production and processing, such as modern beehives, processing equipment, and storage facilities. This can reduce the upfront capital requirements for individuals and cooperatives.
- **Market Access:** Improved access to finance should be coupled with efforts to enhance market access for honey producers. This includes creating market linkages, improving product quality, and promoting value-added products to increase revenue **streams.**

3.10 Estimated job creation opportunities in Apiculture

Apiculture, or beekeeping, can indeed create significant job opportunities in Rwanda. The country's agricultural landscape, climate, and commitment to sustainable development make it a suitable environment for apiculture. Here is an estimate of the job creation opportunities that apiculture can offer in Rwanda:

- **Beekeepers:** The heart of Rwanda's apiculture industry revolves around dedicated beekeepers who oversee the management of beehives, the meticulous collection of honey, and the attentive care of their buzzing colonies. Beehive multiplication plays a pivotal role in this industry, necessitating the initial relocation of bees from traditional hives to modern ones, or orchestrating a local transfer referred to as 'Guca kwinzuki' in the event of a new queen's emergence. This transfer serves as a vital tool for beekeepers, facilitating hive transitions or bee relocations prompted by factors like external threats and various other circumstances, ensuring the continued health and productivity of the bee colonies.
    - This industry can provide employment opportunities for many individuals, including rural farmers and young people seeking sustainable livelihoods. The number of beekeepers can vary depending on the scale of operations, but it's not unusual for a single beekeeper to manage multiple hives."
- **Honey Harvesters:** Harvesting honey and other bee products such as beeswax and propolis requires labor. These tasks can provide seasonal employment opportunities for individuals in rural areas, particularly during the honey harvesting seasons.
- **Honey Processors:** After honey is harvested, it needs to be processed, filtered, and packaged. This stage of the apiculture value chain can create job opportunities in small-scale processing units, cooperatives, or even larger honey processing factories.
- **Value-added Products:** Beyond honey, there are numerous value-added products such as beeswax candles, honey-based cosmetics, and mead (honey wine) that can be produced. These products can generate additional employment, especially if there is a growing market for them.
- **Sales and Marketing:** The apiculture industry also requires individuals involved in sales and marketing. These professionals help promote honey and other bee-related products to domestic and international markets, creating job opportunities in sales, distribution, and branding.
- **Research and Development:** Rwanda's commitment to sustainable agriculture means there may be opportunities for research and development in beekeeping practices, bee health, and product innovation. Researchers, scientists, and technicians can find employment in this field.

- **Training and Education:** As the apiculture industry grows, there will be a need for training and education programs to teach beekeeping best practices. Trainers and educators can find employment in government initiatives, NGOs, or private training centres.

- **Beekeeping Equipment and Supplies:** The manufacturing or distribution of beekeeping equipment and supplies such as beehives, protective gear, and tools can also create job opportunities within the country.
- **Export Opportunities:** With the right infrastructure and quality control measures in place, Rwanda can tap into international markets for honey and bee-related products. This can lead to job opportunities in export logistics and quality assurance.
- **Ecotourism:** Beekeeping can be integrated into ecotourism initiatives, offering employment opportunities in guiding beekeeping tours, managing beekeeping-related attractions, and hospitality services.

It is important to note that the actual number of jobs created will depend on the scale of the apiculture industry's growth and the level of investment and support it receives from the government and other stakeholders. Additionally, sustainable and environmentally friendly beekeeping practices should be emphasized to ensure the long-term viability of the sector and its job opportunities in Rwanda.

Youth in Rwanda have limited physical assets (such as land, livestock, or houses). The beekeeping value chain is made up of interconnected parts that work together to provide long-term job and income opportunities, continuity, sustainability, greater production, food security, and the battle against malnutrition.

Youth beekeeping is linked to environmental conservation, honey packing, increasing food for bees, improved Packaging to reduce losses, and export promotion of honey products. Beekeeping is a one-time investment that doesn't require the biggest land, and some time you can use public spaces. Based on the above calculation, it was found that between 20 and 28 kilograms of honey are produced on average per modern beehive per year. Based on the both export and import trends, Rwanda need to produce an additional 5,000 tons of honey.

Table 8: Estimating the income and total jobs for adding 5,000 tons of honey in Rwanda

Items	Estimates
New additional honey production of honey needs (kg)	5,000,000
Number of Hives needed	208,333
Cost per Hive (Frw)	60,000
Total cost of Hives (Frw)	12,499,980,000
Additional cost (Estimated cost 20%)	2,499,996,000
Total estimated Income (5,500 Frw Kg)	27,500,000,000
Total number direct jobs with 60,000Frw per month	34,375
Marginal Benefit before taxation	12,500,024,000

Source: Estimates based on data provided by beekeepers, September 2023

As per the table above, Rwanda needs to inject around Frw 15 billion to generate almost double the amount calculated based on the domestic price and create almost 35,000 direct jobs with a salary of Frw 60,000 per month on average. If considering the export, the amount will quadruple.

Chapter Four: SWOT Analysis for the Honey Value Chain in Rwanda

A SWOT analysis (Strengths, Weaknesses, Opportunities, Threats) provides a framework for evaluating both the internal and external factors that affect a particular subject or business. Applying this to the honey market value chain, it's essential to consider each segment, from beekeepers and honey production to processing, packaging, distribution, and retail. Each segment will have its own unique strengths, weaknesses, opportunities, and threats. The below SWOT analysis provides a more general overview of the honey market as a whole in Rwanda.

4.1 Strength

- **Rich Floral Diversity:** There is wide array of ecosystems, including forests filled with flowering plants and trees, as well as swamps, which offer abundant forage for bees. These natural havens could serve as essential buffer zones for bee populations. The remarkable diversity of flora here translates into a kaleidoscope of honey flavours and types, a tantalizing prospect for discerning consumers.
- **Agricultural Abundance**: The availability of ample agricultural land suitable for crops such as cassava and sweet potatoes provides an abundant source of sustenance for bees in the region.
- **Community Collaboration**: Farmers are organized into associations, facilitated by AVIS, which fosters collaboration essential for maintaining bee colonies and sharing crucial resources like equipment and training.
- **Access to Lucrative Markets:** The district enjoys geographical proximity to the secondary city of Huye and the capital city of Kigali. This advantageous location ensures easy transportation, lowering costs, and significantly improving access to lucrative markets. Consequently, it becomes more convenient to sell honey and related products in the bustling City of Kigali.
- **Governmental and District Support:** Three sampled Kamonyi Districts benefit from a robust framework of policies and regulations that safeguard the beekeeping ecosystem. The Ministry of Agriculture has played a pivotal role by equipping beekeepers, individuals, associations, and cooperatives through comprehensive training programs. Notably, various members have received training in various aspects of beekeeping, including honey production, bee health, pollination, and essential measures to protect bee colonies against threats like varroa mites, wax moths, hive beetles, Dracula, propylaea's, American foulbrood, European foulbrood, Nosema, chalk brood, among others.

- **Local Beekeeping Expertise:** The sampled districts are fortunate to be home to seasoned beekeepers who possess invaluable local knowledge and time-honored traditions related to beekeeping.

With adequate support, these experienced beekeepers can become invaluable mentors and founts of expertise, particularly for young individuals, women, and people with disabilities eager to engage in beekeeping.

- **Medicinal and Health Benefits:** Honey has well-documented health benefits, which include antibacterial properties, wound healing, and its use as a cough suppressant, among others.

- **Rwanda favorable Climate and geographical position for beekeeping:** The country has a pleasantly warm and tropical highland climate, moderate precipitations, mountains, hilly areas, and various plants and faunes.
- **Growing popularity of organic food:** the growing popularity of organic food is driving the demand for honey, which is considered as natural and organic sweetener. This is leading to an increase in beekeeping activities, which is boosting the growth of the beekeeping market.
- **Dependence on bee population**: Honey production is entirely dependent on the health and wellbeing of bees. Bee population are under threat from various factors such as pests, diseases and environmental changes which presents a significant risk to the business.
- **Rising awareness about the health benefits of honey:** honey is a natural sweetener with numerous health benefits. The increasing awareness about the health benefits of honey is driving the demand for honey, which is boosting the growth of the beekeeping market.
- **Increasing demand for honey and other bee products:** the growing demand for honey, beeswax, propolis, and other bee products is driving the growth of the beekeeping market.
- **Direct to consumer approach:** One of the biggest strengths of the honey production business is its direct to consumers approach, which cuts out the middlemen and allow producers to sell directly to end consumers. This not only increases the profit margin but also helps in building a loyal customer base.
- **Locally sourced honey**: Honey producers can differentiate themselves by offering unique blend of locally sourced honey. Which can attract customers who are looking for locally produced and sustainable products.
- **The diverse entomophilous wild flora**: There are about thousands plant species in Rwandan territory, which are scattered in different relief zones according to altitude, climate, and soil type. Since the majority of these plants are entomophilous, bee colonies can gather the nectar, perform their tasks of pollinating this flora, and help to preserve biodiversity. The wide range of agricultural crops is advantageous to beekeeping since they provide a plentiful supply of nectar and facilitate pollination from the perspective of bee colonies.

4.2 Weaknesses

- **Low Production Yields**: All districts, including Kamonyi, Gatsibo, and Nyabihu, are experiencing low honey production yields per hive or per beekeeper, ranging from 3-5 kilograms from traditional beehives. This issue is primarily attributed to the low cost of modern beehives, which are priced at fifty thousand francs. The use of traditional hives results in low harvests, inadequate hive management, diseases affecting bee colonies, and insufficient forage resources for bees, all of which contribute to diminished yields.
- **Lack of Quality Control:** The absence of quality control measures in honey production and processing leads to inconsistent product quality. Honey with impurities, contamination, or variations in flavor and texture may not fetch favorable prices in the market. Additionally, honey from other sources, such as Tanzania, is being sold at a lower price of 3500 francs per kilo compared to the 5000 francs per kilo for locally produced honey.
- **Limited Access to Modern Beekeeping Techniques**: Outdated beekeeping practices and limited access to modern beekeeping techniques and equipment hinder the efficiency of honey production. This includes inadequate training, a lack of access to improved hives, and insufficient knowledge about bee health management. Although the Ministry and RAB have been providing training to beekeepers, there is still a shortage of beekeeping knowledge among farmers.
- **Inadequate Infrastructure:** The honey value chain is negatively impacted by poor transportation facilities and storage infrastructure. The absence of modern collection centers and subpar storage facilities can result in spoilage, delays, and increased costs.
- **Market Access:** Limited access to markets, particularly those offering higher prices, is a significant weakness. Failure to meet national honey standards may force beekeepers to sell their honey at lower prices locally, leading to reduced income.
- **Lack of Processing Facilities:** The limited availability of honey processing facilities in the district restricts opportunities for value-added honey products. Processing activities may include filtering, packaging, and creating value-added products such as honey-based cosmetics or health products.
- **Pests and Diseases:** Beekeeping is susceptible to pests and diseases that can devastate bee populations, including varroa mites, wax moths, hive beetles, and various diseases like American foulbrood and European foulbrood. Weaknesses in disease management strategies can result in colony losses.
- **Climate Change Impact:** Changes in weather patterns, particularly during dry spells and shifts in climate, affect the availability of flowering plants for bees, potentially leading to a scarcity of honey.
- **Limited Access to Finance:** Beekeepers encounter challenges in accessing financing to expand their operations, invest in equipment, or engage in value addition activities. This is due to the fact that beekeeping is not recognized as a priority agriculture sector, unlike livestock or maize production. There is limited awareness in the district, making microfinance institutions hesitant to invest in a business with unpredictable profitability.

- **Lack of Training and Extension Services:** Insufficient access to beekeeping training and extension services can limit the knowledge and skills of local beekeepers, hindering their ability to improve their practices. Furthermore, the sector is predominantly comprised of elderly individuals, many of whom are uneducated or have limited education, which hampers their participation in modern beekeeping practices. Some are strongly attached to traditional hives, believing them to produce higher-quality honey than modern hives.
- **Environmental Concerns:** Unsustainable beekeeping practices and the use of pesticides and agrochemicals in agriculture, such as the use of rocket in maize, harm bee populations and honey quality. Additionally, safety and security concerns regarding beehives, including the need for security measures and regular visits, may limit the involvement of people with disabilities in beekeeping. Deforestation and external threats also have adverse effects on beekeeping.
- **Regulatory Barriers:** Stringent regulations or a lack of clarity in regulations related to beekeeping and honey production create barriers for beekeepers and honey producers. For instance, recent restrictions on the use of plastic or single-use bottles, with an emphasis on the use of glass bottles, have increased the cost of honey materials and restricted innovation in the beekeeping sector.
- **Seasonal Production**: Honey production is highly seasonal, which can result in unpredictable revenue streams for the business. During the offseason, producers may struggle with maintaining sales and revenue.
- **Weather conditions:** Extreme weather conditions such as droughts or floods can negatively impact honey production, affecting both quantity and quality of the product.
- **Costs of production:** Honey production can incur high costs such as equipment, labour and packaging. These costs may be prohibitive for smaller producer and can impact profitability.
- **Inadequate access to finance and High-risk perception of beekeeping:** Financial institutions lack sufficient confidence in the sub-sector and actors (beekeeping farmers). The agriculture sector in Rwanda is facing challenges related to financial services. Very low financing is available, not adequate and no affordable financial services limit the performance of the beekeeping value chain.
- **Weak financial capacity of the co-operatives:** Poor management, low level of productivity and insufficient savings denies members essential financial services they were seeking when they joined the co-operative.
- **Leadership, management and governance issues:** Cooperative societies have frequently taken out loans from commercial banks and MFIs and missed a number of repayment instalments, nearly going into default. Relationships with financial institutions are strained because of these experiences, which also causes people to have less faith in cooperative societies.
- **Adulteration and Quality Concerns**: One of the major challenges is the adulteration of honey with cheaper sweeteners, which damages the reputation of genuine producers.

- **High cost of collection due to scattered small scale producers:** Dealing with small and scattered beekeepers which is costly and time consuming.
- **Cost of production:** the cost of production can be quite high due to factors such as purchasing and maintaining bee colonies, labour costs, marketing expenses, and packaging materials. These costs can impact the producer's profitability, especially in the face of stiff competition.
- **Limited access to modern production skills:** Rudimentary processing technologies and skills resulting to poor quality honey. There is still limitation use of the improved and good quality farm equipment which results not meeting the required standards. Poor packaging materials and labels

- **4.3 Opportunities**
- **Direct-to-consumer sales:** selling honey directly to consumers through online stores, farmers' markets, and local stores provides the opportunity for a higher profit margin and builds stronger relationships with customers.
- **Bulk sales to businesses:** Honey producers can reach out to businesses such as gourmet food stores, restaurants, and bakeries to sell their products in bulk, providing a consistent revenue stream and long-term partnerships.
- **Current and high demand for honey both locally and in the export market**: the volume of honey imports to Rwanda has considerably increased, and yet there are other potential opportunities for exporting honey given the quality and standards of local honey.
- **High demand for processed and well-packed honey:** The demand is especially high for refined, high-quality honey free from pesticides, insecticides and other agro-chemicals. There is a high demand. In the domestic market for use for personal consumption and beverage and confectionary industry
- Availability of modern, tested equipment and technologies, especially beehives and harvesting technologies

4.4 Threats

- **Weather and Climate Change**: Weather and climate change can have a severe impact on honey production, and beekeepers can face production loss due to unfavorable weather conditions or excessive use of pesticides, which can harm bees and their hives. Changing weather patterns can affect the natural habitats of bees and the flora they depend on.
- **Competing Sweeteners:** As new natural sweeteners emerge, honey could face competition.
- **Pesticides and Diseases**: The widespread use of pesticides can be detrimental to bee populations, and diseases can wipe out entire colonies. Bees can succumb to pests and various diseases, which can damage the hives, reduce honey production, and even lead to colony collapse.
- **Regulatory Changes**: Governments could impose stricter regulations on honey production, processing, or labeling, potentially increasing costs for producers.

- **High Dependency on Ecological Factors**: The health of bees is crucial. Factors such as climate change, pesticides, and diseases can drastically affect production.
- **Supply Chain Complexities:** Ensuring the traceability and authenticity of honey from source to consumer can be complex.

Chapter five: Specific information, Analysis and Insights on beekeeping in the selected and sampled districts

5.1 Introduction

Throughout this comprehensive assessment, our approach encompassed a meticulous examination of secondary data through rigorous desk reviews, complemented by enlightening consultations through key informant interviews. However, the cornerstone of our investigation was the intensive scrutiny of Kamonyi, Gatsibo, and Nyabihu districts. In these areas, we delved deeply into the intricate intricacies of beekeeping, unveiling a nuanced tapestry of stakeholders, prospects, and obstacles.

Our primary assessment yielded a treasure trove of insights, spanning the entire spectrum of the apiculture industry, from honey production methods and the provision of beekeeping equipment to training and extension services. Moreover, we meticulously examined honey extraction processes, followed its journey through processing, packaging, and branding, and ventured into the realms of marketing, sales, and potential export opportunities.

It should be noted that the information mentioned below was obtained during the interview with district officials, beekeeping, and honey production players during the data collection process in the districts of Kamonyi, Gatsibo, and Nyabihu, including NGOs, the business sector, cooperatives, and individual farmers. The honey value chain has several stages, from bee multiplication through input suppliers to honey processing, marketing, and export; thus, it is important to promote opportunities for young people, women, and people with disabilities at each stage.

5.2 Identified opportunities and services in sampled districts

During the field visits, it was found that in these three districts, there are various opportunities and services that are associated with the beekeeping value chain, as summarized below:

Hive construction: In three districts, beekeepers found success in offering hive construction services, focusing on durability, easy maintenance, and compatibility with local bee species to meet clients' needs. This approach supports sustainable beekeeping in the region.

Source: Picture taken on 12th September 2023 in Kamonyi District, youth in hive making

1) **Beekeeping Equipment:** essential beekeeping equipment such as smokers, protective gear, bee brushes, and extraction tools. These items are necessary for beekeepers to safely handle their bees.
1) **Bee Breeding and Queen Rearing**: opportunity in specialized breeding high-quality bee colonies and queen bees. High-quality queens can significantly improve the productivity of bee colonies.
2) **Honey and Hive Products Processing:** Invest in honey extraction and processing equipment to create value-added products like beeswax candles, royal jelly, pollen, and propolis. These products can fetch higher prices in the market.
3) **Pollination Services:** Offer pollination services to local farmers, especially those with orchards or crops that rely on pollinators. This can generate income while helping to improve crop yields in your area.
4) **Local Honey Sales:** sales persons for produced honey and hive products directly to consumers, farmers' markets, or through online platforms. Local honey is often in high demand due to its perceived health benefits.
5) **Bee Health Consulting:** specialised opportunity to provide consulting services to beekeepers to help them diagnose and treat bee diseases, manage pests, and implement best practices for hive maintenance.
6) **Beekeeping Tourism:** opportunities offering beekeeping tours and experiences.

5.3 Beekeeping equipment supply in selected Districts

- **Beekeeping training and extension services:** collaborate with local agricultural schools or organizations to provide beekeeping training to make such boxes. Students pursuing carpentry in IPRCs trained to make beehives. Offer training programs and workshops on modern beekeeping techniques, hive management, and honey production to both youth and women and people with disabilities. Offer training programs and workshops on modern beekeeping techniques, hive management, and honey production to both youth and women.

- **Honey extraction processing and processing:** there are training opportunities for youth and women in honey processing techniques, including packaging, branding, and creating value-added products like honey-based cosmetics, beeswax candles, and mead. Support the establishment of small-scale honey processing facilities.
- **Establish Cooperatives and Associations:** Encourage the formation of beekeeping cooperatives or associations that can pool resources and negotiate better prices for honey and bee-related products. Nyabihu Beekeepers Cooperative Union (NBCU): Has 95 women, 120 men, 45 youth, and 4 , NBCU purchases honey from local cooperatives at 4,500 RWF per kg and sells it at 6,000 RWF per kg. Records are meticulously kept to ensure fairness in honey transactions.

Other products include Ornaments, beeswax, candles, jelly and honey.

- **Marketing and Sales:** create linkages between beekeepers, honey processors, and retailers to ensure a steady market for honey products. Increase honey production and create partnerships with local and international buyers interested in purchasing honey and related products. This will resolve the problem of seasonal products. Therefore, the increase in production will enable the production of enough honed Farmers mentioned that there are two seasons: July to September and January to March. Partnership with existing firms, there are other opportunities to train youth and women in packaging, branding, and creating value-added products like honey-based cosmetics, beeswax candles, and mead.

- **Export:** High-quality honey for export is highly required, and to achieve these international standards and even local standards, as in Rwanda you cannot sell any product, especially in supermarkets and other distribution channels with standard certificates, there is a need to assist beekeepers and processors in obtaining certifications like organic, fair trade, or HACCP, which can increase the value of their products.

- **Access to Capital and Resources**: Facilitate access to financial resources, such as microloans or grants, specifically targeted at young entrepreneurs, women and people with disabilities interested in beekeeping. Provide access to affordable beekeeping equipment, hives, and protective gear.

Honey Processing and Value Addition: Train youth and women in honey processing techniques, including packaging, branding, and creating. Value-added products like honey-based cosmetics, beeswax candles, and mead. Support the establishment of small-scale honey processing and packing facilities to replace traditional ones. Honey sold in plastic water bottle affects the quality and quantity of honey.

Source: Gatsibo District Honey collection centre.

- Market Research and Business Development: Conduct market research to identify potential niches and export opportunities for honey products. Provide business development training to help youth and women create viable business plans and marketing strategies. **Infrastructure Development:** Invest in storage facilities to reduce post-harvest losses and improve access to markets. There opportunities in proper honey handling and storage for value addition. Nyibihu Beekeepers cooperative union is comprised of seven cooperatives of seven sectors: Kabatwa, Bigogogwe, Jenda, Mukamira, Karogo, Rumbura, Mulinga.

Source: Nyabihu District processing room

Best Bee Overall Maker awarded.

Testing honey with a fractometer.

- **Environmental Conservation:** Emphasize sustainable beekeeping practices that protect the environment and pollinators, which are essential for agriculture.
- **Promotion and Awareness:** Launch marketing campaigns to raise awareness of the benefits of honey consumption and its role in supporting local communities. Engage in social media and online marketing to reach a broader audience.
- **Government and NGO Support:** Collaborate with government agencies and NGOs working in agriculture and rural development to access additional resources and support. Today, there are few NGOs keeping AVIS and world vision. However, more have expressed interest in beekeeping.

5.4 Additional other challenges identified in three selected Districts

- **High unemployment rate, NEET and high rate of non-educated youth:** There is a high youth unemployment rate ranging from 20% to 25% depending

on quarterly, but mostly the biggest challenges are related to the biggest number of youth falling under the category of youth NEET (youth not in employment, education, or training), which is very high (34% on average), the poverty rate levels, and the high proportion of youth who are not educated and those with primary levels, which if combined, are almost 70% (for more detail Cfr to NISR, Labour Force Survey and Rwanda Population Census of 2022).

- **Lack of Information and Commitment:** Lack of information and commitment can be addressed through education and awareness programs. These programs should not only focus on the technical aspects of beekeeping but also emphasize the long-term benefits and sustainability of the industry. It's essential to instill a sense of commitment among young beekeepers, as this can lead to greater success in the sector.
- **Financial Constraints:** Inadequate finances are stifling the aspirations of our young beekeepers. We need to establish accessible financial support systems tailored to their needs, enabling them to thrive in the beekeeping business.
- **Seasonal Honey Harvest:** The seasonal nature of honey harvest is a significant challenge for continuous production. We can address this by exploring innovative preservation techniques and value-added honey products to create year-round opportunities for our youth.
- **Limited Equipment:** The high cost of honey extraction equipment is a formidable barrier. We must collaborate with industry stakeholders to provide affordable equipment options, making it easier for young beekeepers to get start-up capital.
- **Lack of Modern Hives:** The predominant use of traditional hives hampers efficiency. Initiatives to subsidize modern hive adoption, potentially through cooperatives like Koabiru and NBCU, should be considered to enhance production and profitability**.**
- **Limited Youth Engagement:** It's crucial to encourage youth involvement in the beekeeping sector actively. Creating mentorship programs and offering incentives for young beekeepers will rejuvenate the industry.
- **Bee Health and Security:** Pest issues and security concerns are real threats. Investment in research and education on hive protection and bee health management is vital.
- **Low Awareness and Campaigns:** Effective campaigns are essential to promote beekeeping as a viable career choice. We should engage the community, educational institutions, and media to spread awareness and enthusiasm about beekeeping.
- **Competition from Imported Honey:** Imported honey from Tanzania is affecting local pricing and authenticity. We should explore strategies to protect our local honey market, potentially through quality certifications and marketing campaigns.

- **Limited Investment and Funding:** A shortage of investors and low financial support is hampering sector growth. Collaborative efforts with financial institutions and government programs are needed to boost investments in beekeeping.

- **Need for Training:** Training is essential for both traditional and modern beekeeping methods. Developing accessible training programs and ensuring effective knowledge dissemination is critical for success.
- **Predominance of Elderly:** Beekeeping is primarily undertaken by older individuals. Encouraging intergenerational knowledge transfer and creating opportunities for young beekeepers is crucial for revitalizing the industry.
- **Pesticides:** Pesticide use threatens bee populations. Advocacy for responsible pesticide usage and collaboration with agricultural sectors to adopt bee-friendly practices are necessary steps.
- **Financial Investments:** to expand beekeeping and enhance profitability, there is a need to attract more financial investments. This can be achieved by showcasing the industry's potential and its positive impact on the community and the environment.
- **Financial Constraints:** Accessible financial support systems are crucial for the growth of young beekeepers. Microfinance initiatives and government-backed loans tailored to the needs of beekeepers can provide the necessary capital to invest in hives, equipment, and expansion**.**
- **Seasonal Honey Harvest:** To overcome the seasonal nature of honey harvest, the development of innovative preservation techniques and diversification into value-added honey products, increasing use of modern hives, training and supply of other honey equipment are essential. This can help beekeepers generate income year-round and reduce the impact of seasonality.
- **Limited Equipment:** Collaborating with industry stakeholders to provide affordable equipment options is a practical solution. .
- **Lack of Modern Hives:** Subsidizing modern hive adoption, potentially through cooperatives, is a valuable strategy. Involvement of educational institutions to incorporate beekeeping into their school curriculum can lower the entry barrier for young beekeepers and stimulate industry growth. y to improve efficiency and productivity in beekeeping. Modern hives can enhance honey production and quality.
- **Limited Youth Engagement:** Encouraging youth involvement is crucial for the long-term sustainability of the industry. Mentorship programs, incentives, and educational initiatives can attract young talent to beekeeping and ensure the transfer of knowledge from older generations.
- **Bee Health and Security:** Investment in research and education on bee health management and hive protection is vital. This helps beekeepers address pest issues and maintain the health of their colonies, ensuring sustainable honey production.
- **Low Awareness and Campaigns:** Effective awareness campaigns are essential to attract individuals to beekeeping as a viable career choice. Collaboration with educational institutions and media can help spread enthusiasm and knowledge about the industry**.**
- **Competition from Imported Honey:** Protecting the local honey market from imported honey requires strategies such as quality certifications and marketing campaigns to emphasize the uniqueness and quality of local honey products.

- **Limited Investment and Funding:** Collaborative efforts with financial institutions and government programs can attract more investments into beekeeping. Highlighting the economic and environmental benefits of beekeeping can make it an attractive investment option**.**
- **Need for Training:** Accessible training programs are fundamental for beekeepers to adopt best practices. These programs should cover both traditional and modern beekeeping methods and focus on knowledge dissemination.
- **Predominance of Elderly:** Encouraging intergenerational knowledge transfer and creating opportunities for young beekeepers is essential for rejuvenating the industry and ensuring its continuity**.**
- .

Source: Nyabihu Bee farmers *Gatsibo farmer*

- Pesticides: Advocacy for responsible pesticide usage and collaboration with the agricultural sector to adopt bee-friendly practices can help protect bee populations and the sustainability of beekeeping.
- Financial Investments: Demonstrating the positive impact of beekeeping on the community and the environment can attract more financial investments. Highlighting its potential as a sustainable and profitable industry can encourage both private and public investments

Addressing these challenges requires a coordinated effort involving government, industry stakeholders, financial institutions, and the community. By tackling these obstacles systematically, Rwanda can potentially foster a thriving and sustainable beekeeping sector, especially among its youth.

5.5 Beekeeping special SWOT Analysis of selected Districts

Below are specific SWOT analyses conducted in three selected districts that reflect particular aspects that were highlighted during key informants in the sampled districts.

5.5.1 SWOT Analysis in Kamonyi

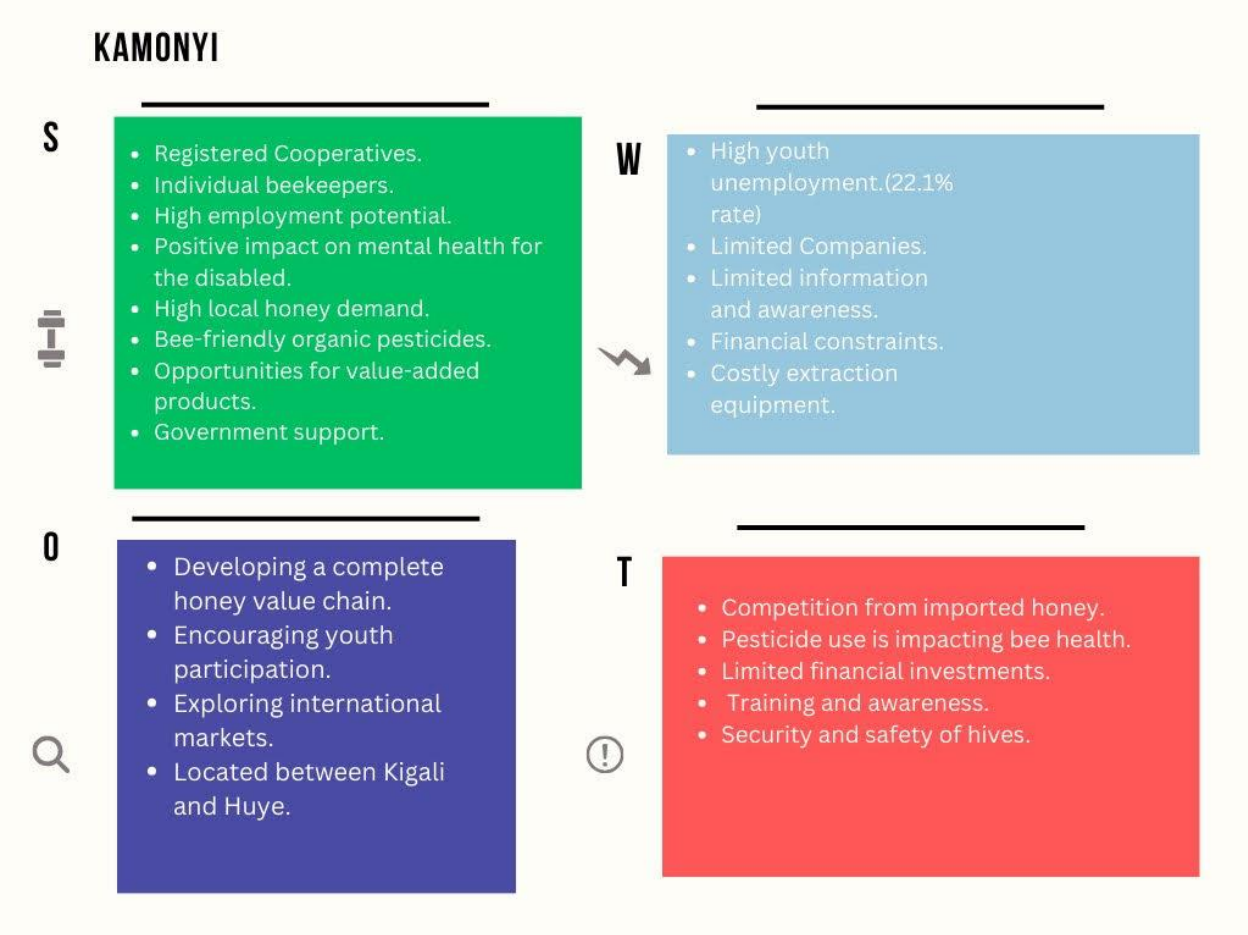


Figure 4: Kamonyi Honey VC SWOT Analysis

5.5.2 SWOT Analysis in Gatsibo District

Figure 5: Gatsibo VC SWOT Analysis

5.5.3 SWOT Analysis in Nyabihu District

Figure 6: Nyabihu VC SWOT Analysis

In conclusion, addressing the intertwined challenges of youth, women, and people with disabilities unemployment alongside the revitalization of the beekeeping sector in Kamonyi, Gatsibo, and Nyabihu Districts demands a comprehensive, collaborative approach involving government bodies, development partners, the private sector, cooperatives, beneficiaries, communities, financial institutions, and educational institutions. This collective effort aims to create a brighter and more inclusive future for youth, women, and people with disabilities while ensuring the sustainability and growth of the beekeeping industry. This initiative not only benefits the individuals involved but also contributes to the overall economic and social development of the districts, highlighting the transformative potential of collaboration in addressing complex issues and promoting prosperity and equity for all.

5.6 Conclusion and Recommendations

Below is a summary of the recommendations and suggestions provided by various interviewed stakeholders, particularly beekeepers, companies, and cooperatives. The projects and interventions should strive to prioritize these recommendations.

- **Provide Training:** Comprehensive training programs should be offered to aspiring beekeepers, focusing on both traditional and modern beekeeping methods.
- **Support on standards implementation and operationalization Strict Regulations:** Stringent rules should be implemented to ensure the safety and sustainability of beekeeping practices.
- **Awareness Campaigns:** Continuous engagement with beekeepers through mobilization campaigns is essential for fostering commitment and sustainability.
- **Financial Support:** Initiatives supporting start-ups, including hive and bee purchases, should be developed, with monitoring and accountability mechanisms.
- **Diversification**: Encourage beekeepers to explore value-added products to optimize income.
- **Evening Pesticide Spraying**: Encourage evening pesticide spraying to minimize impact on bee activity.
- **Government-Sponsored Hive Locations:** Advocate for government support in providing designated areas for hive placement.
- **Knowledge Transfer:** Promote experienced elders' knowledge transfer to mentor young beekeepers.
- **Collection Centers:** Establish collection centers in every sector for ease of honey distribution.
- **Investor Engagement:** Seek investors interested in beekeeping and honey production.
- **Fair Pricing:** Ensure fair pricing and distribution of honey to motivate beekeepers.
- **Security for Hives:** Enhance hive security to prevent theft and bee population decline.
- **Clean Transportation of honey to collection centers:** Develop proper transportation methods to maintain honey quality.
- **Sustainability:** Promote sustainability in beekeeping practices, including eco-friendly hive placement.
- **To improve the quality production of the smallholder beekeepers**
- Strengthening climate resilient extension services for beekeepers (production, harvesting)
- Strengthening access to inputs (adequate beehives, tools)
- Strengthening research (bee health, bee genetics, climate resilience)
- Increase adequate zones for beekeeping activities
- Increase plantation of melliferous trees and plants
- Awareness campaigns on the impact of pesticides on beekeeping, importance of biodiversity, …
- Strengthening producer organisations and cooperatives in governance and service delivery to their members
- Accessible Beekeeping for People with Disabilities: Design and develop beekeeping equipment and techniques that are accessible to people with

disabilities, such as those who have difficulty walking. This could involve creating raised hives, adaptive tools, and accessible apiaries.

- Beekeeping Education for People with Disabilities: Offer specialized beekeeping education and training programs for individuals with disabilities, providing them with opportunities for meaningful employment and engagement in the beekeeping industry.
- Gender Empowerment: Promote gender equality and empower women by ensuring their active participation in all aspects of the honey value chain, from production to marketing and the tailoring of beekeeping suits.

Chapter Six: Beekeeping Best practices

Apiculture can provide livelihoods or a source of income for many rural areas and small farms. Modern apiculture is shifting towards a farming system that is more sustainable and respectful of indigenous bees. But sustainable apiculture requires good knowledge (and training) on the proper management of bees to optimize the natural systems and resources that beekeepers rely on. Furthermore, state-of-the-art technologies and innovations may strongly enhance beekeeping activities.

Bees are vital to the health of the environment and their pollination activity supports biodiversity, making it the most important agro-environmental service. In fact, the value of bee pollination is estimated to be 30–50 times greater than the value of hive products such as wax and honey. In fact, close to 75 percent of the world's crops producing fruits and seeds for human consumption depend, at least in part, on pollinators for sustained production, yield and quality with an estimated 10 percent of the total economic value of agricultural output for human food dependent on insect pollination. Unfortunately, external stressors frequently interfere with bee productivity and services. These include land-use changes, disease and pests, indiscriminate use of chemicals (veterinary medicines and/or pesticides), climate change, spread of monocultures, globalization (which implies the introduction of invasive species of pathogens), and poor management practices. All of these stressors affect not only bee health, but also the quality and quantity of bee products and services provided by the bees, reducing both income for beekeepers and the positive effect of bees on the environment.

Policymakers, governmental institutions and all those implementing development projects in beekeeping should be aware of the hurdles, the advantages for the environment and proper practices when planning a new beekeeping activity or making an already existing beekeeping activity more efficient and sustainable. sustainable approach, including proper procedures that beekeepers should follow to obtain high quality and quantity of bee products (live bees, honey, pollen, wax, propolis, royal jelly, etc.) are described in detail. Of course, beekeeping practices vary depending on the type of bee (*Apis mellifera* spp., *Apis cerana* spp., *Melipona* spp. or stingless bees, and *Bombus* spp. or bumblebees), the geographical area and the kind of beekeeping practiced.

6.1 Good beekeeping practices

Beekeeping is concerned with the practical management of social bee species, often within farming systems, and significantly contributes to food and nutrition security, poverty alleviation and economic growth.

An innovative, sustainable, integrative approach that considers all steps of the beekeeping value chain, from ensuring a sustainable floral resource base and breeding bees, to harvesting hive products and enhancing bee services (mainly pollination services), is critical to sustainable beekeeping enterprise development.

6.1.1 Factors influencing the quality honey production

Below are factors influencing the quality honey production

i. Beehive technology as a factor affecting quality of honey production

Beekeeping involves maintaining honey bee colonies in hives, with various types of hives used worldwide. Low-technology hives offer advantages of movable frame hives, such as standardization, manageability, and efficient honey harvest, without high costs. These hives can be constructed from locally available materials and can be moved between crops as they flower. Modern hives allow beekeepers to examine colony conditions and harvest honey without disturbing combs, ensuring good quality honey without pollen or brood contamination.

ii. Harvesting and processing methods

Harvesting and processing methods have become crucial for agricultural development programs. Harvesting and processing techniques affect the final quality of honey. Beekeepers harvest honey by cutting combs and placing them in containers. Processing honey is a sticky operation requiring patience and careful protection against contamination. Honey is hygienic and must be handled hygienically, with clean equipment and dry equipment. Overwatering can cause fermentation.

iii. Influence of agrochemicals on honey quality

Insecticides, herbicides, and fungicides are harmful to the environment, causing significant damage to honeybees. These chemicals reach bees through pollen, nectar, air, water, or soil, causing immediate death. Some pesticides allow bees to return home and then die, while others damage young, immature bees. Insecticides have historically caused fatal incidents and honey contamination, leading to low-quality honey production. Beekeepers face major problems due to exposure to worker bees, beeswax contamination, and organic contaminants like grayanotoxins and Organic contaminants and polychlorinated biphenyl (PCB’s).

iv. Influence of intensified farming practices on the quality of honey Intensification

Intensification of agriculture is causing a decline in honey production and quality due to the loss of natural habitats for bees, such as agroforestry systems, grasslands, and hedgerows. This intensification also leads to significant losses of biodiversity on farmland, as industrial farming monocultures limit bee access to food. Urbanization and intensification are causing the fragmentation of natural habitats, affecting bees' growth and reproduction.

v. Honey bee Pests and Predators

Honey bee colonies are home to various beetles, most of which are harmless and feed on pollen or honey. However, weak colonies or storage combs are affected. A common beetle lives and multiplies within and outside colonies, depositing larger nests of eggs in fissures and recesses. Its larvae, whitish and covered with a sticky coating, prefer pollen and honeycombs. Wandering small hive beetles leave smear trails inside and outside the colony. Ants are a common predator of honey bees in tropical and subtropical Asia, attacking hives massively, taking everything in, including adult bees, brood, and honey. Ants can also be a nuisance to beekeepers and cause pain from their bites. Beekeeping in tropical climates often suffers from damage caused by amphibians like toads and frogs.

6.1.2 The main pillars for sustainable beekeeping

The main pillars to consider for sustainable beekeeping are the environment, genetics, practices, education and extension services.

1. **Environment:** The external environment, including environmental parameters and biodiversity, constitute the “external” factors that may influence aspects such as foraging activity, availability of flowering plants, physical stressors and ultimately, the products and the services provided by bees. These external factors include the natural environment (climate conditions). The quality and quantity of nectar and pollen sources and the diversity of the plants available to bees are fundamental to the success of beekeeping systems and are, in some cases, able to be influenced and managed by human interventions.
2. **Genetics:** Bee genetics are a critical factor for production, health, and sustainability of beekeeping systems. Other than choosing local bees that can cope with the natural and managed environment, certain characteristics can be improved by breeding activities. For this reason, the conservation of indigenous bee species and local genetic diversity is important to the long-term viability of bee species and beekeeping enterprises. Locally adapted stock may also be better suited to specific environmental pressures and so more productive and sustainable in these environmental systems than introduced bee species or genotypes. In most cases, autochthonous bees should be favored over allochthonous species.
3. **Practices:** These include all the beekeeping activities carried out to manage bees for a particular outcome (such as honey production, conservation or pollination services), including appropriate housing, the application of technologies and innovations, good beekeeping practices (GBPs) and biosecurity measures in beekeeping (BMBs). Used in combination, these practices are fundamental to resilient and productive beekeeping systems. GBPs are all those general activities that beekeepers apply in on-apiary production for optimal health of humans, bees and the environment.

They are the basis for application of the BMBs, which include all those operational activities implemented by beekeepers to reduce the risk of introduction and spread of specific bee disease agents.

4. **Education and extension:** These services are fundamental to improving beekeepers' skills on sustainability, helping them to acquire appropriate knowledge and technical skills on GBPs. Effective and ongoing training activities and extension are important to uptake and success in beekeeping systems and can also provide opportunities for beekeepers to build partnerships with researchers, extension units and other relevant authorities to strengthen the honey value chain and collectively answer the sector's new challenges. In conclusion, an impactful approach to beekeeping should consider all these pillars to ensure the development of a sustainable, resilient and competitive apicultural sector which will allow beekeepers to improve the productivity, profitability and sustainability of their enterprises. In this way, the beekeeping sector can become more resilient to shock, seasonality, and stressors, provide income-generating opportunities without exacerbating environmental degradation, enhance crop production, and become more efficient in providing profitable bee products and services.

6.1.3 Harvesting and handling for quality

Any beekeeper who follows simple, good practices can produce high-quality honey, packaged and labelled as required by supermarkets. All projects should invest in training beekeepers and collection-centre staff on the correct methods of harvesting from any type of hive, record-keeping so that product traceability is made possible, and correct post-harvest handling and storage.

a) **Conservation:** Modern beekeeping practices, such as the use of commercially produced genetic stock, queen trade across countries, and migratory beekeeping, contribute to introgression and hybridization of native honeybee populations. If this happens on a large scale, and particularly when the native population is small, it may lead to loss of specific adaptations to local conditions, or even to endangerment of the entire population. Conservation areas have been created in many regions to protect native populations from the influx of foreign genetic material, and were often started by the initiative of local beekeepers. Such areas mostly consist of a protected zone where only colonies of the genetic origin under protection may be maintained, and any commercial or migratory beekeeping activity utilizing commercial or introduced stock is forbidden.
b) **Promote bee welfare:** A good sustainable beekeeping model should always favour practices that create healthy and safe biological conditions, allowing functional expression of innate behavior, and preventing suffering and distress.

While hives provide a suitable home for the bees, the environmental and anthropogenic pressures of the surrounding landscapes still have a major impact on their well-being.

Shaping a suitable environment with diverse foraging resources available throughout the foraging season is key to physiological health and well-balanced nutrition. For this reason, we suggest that beekeepers consider including agricultural farmers and bodies responsible for landscaping in their framework for responsible beekeeping. With honeybees increasingly becoming a flagship species, the public could provide a great deal of support. Reducing market demand for products requiring the intensive service of honeybees is currently impossible, but shifting demand to sustainably managed bee products could be a reasonable alternative. Awareness-raising campaigns for bees, biodiversity and organic products will also bring the citizens closer to the problem. Similarly, increasing awareness about the need for healthy bees and sustainability could increase demand for well-managed beekeeping products, favouring the mutual interest of bees, beekeepers and the environment.

c) **Safeguard flower diversity to improve bee nutrition and health:** The nutritional value of pollen varies considerably depending on the plant species. Adult worker bees rely on the availability of pollen and nectar from flowers. These products are a source of protein, carbohydrates, lipids and other nutrients necessary to support healthy biological processes. The mass flowering crops mainly produced in monocultural farming may not provide sufficient nutrients for a healthy honeybee diet. Nutrition deficits have been found to increase bees' susceptibility to pathogens, making them more prone to disease. Beekeepers should be aware of the implications of a nutrient-poor surrounding landscape for the production and fitness of their hives. A sustainable beekeeping model should support and value agricultural pollinator-friendly practices such as crop rotation and organic farming. Beekeepers should be encouraged to place their hives near crop polycultures which favour plant and animal diversity. The introduction of patches of wildflowers alongside crop cultures could also help ensure a varied bee diet. Measures that can be implemented in urban and semi-natural landscapes include adding areas suitable for nesting and foraging, increasing resources and availability of natural shelters, and providing corridors to restore fragmented habitats.

d) **Control stress factors and prevent pesticide exposure:** To maximize productivity and safeguard the welfare of a colony, beekeepers should consider the impact of stress on honeybee well-being. Oxidative stress is known for its negative effects on many of bees' physiological processes. As mentioned, large-scale agriculture depends on pollination, and migratory beekeeping practices have been found to be associated with increased exposure to stress factors, resulting in a reduced lifespan.

Poor diet as a result of nutrients-limited access, repeated reassessment and readjustment to different environmental surroundings, and increased exposure to agricultural pesticides all cause oxidative stress, which has both minor and major negative effects on bee health. Exposure to chronic stressors can compromise the immune system, metabolic processes and cognitive performance and are thought to be correlated with colony failure.

As such, it is worth repeating that preventing exposure to pesticides is crucial. Establishing a communication network between beekeepers and local farmers would favour effective communication, allowing temporal relocation of bee colonies where application of pesticides may prove strictly necessary. Increasing information flow towards farmers concerning the value of bees for the pollination of particular crops would also increase cooperation between beekeepers and farmers. Finally, beekeepers can cooperate among themselves, creating local databases to track positive or negative trends in bee productivity and general health conditions, as well as threats.

e) **Improving the health and well-being of honeybees:** sustainable beekeeping should centre around honeybee behavioural ecology. There is a need to promote organically managed areas around apiaries, ensure that crop diversity is maintained, and consider the introduction of bee-friendly (nectariferous and/or polliniferous) plants while also preserving naturally occurring wild plant species. Beekeepers should be instructed on how to keep strong and healthy hives, and a rewards system should be in place for beekeepers and farmers complying with low-impact management to their animals and/or plants. A monitoring system should be developed to detect abnormal mortality rates linked with the misuse of pesticides, with investment in technologies aimed at building a reliable network of data concerning population trends. Veterinarians should be trained to effectively assist beekeepers, ensuring that veterinary products are used responsibly. The adoption of indigenous bees should be encouraged, as they are better able to deal with the constraints of their native range. More generally, public awareness should be raised through campaigns on the vital ecosystem services carried out by bees and the crucial need for healthy pollinators and biodiversity in our modern society. Finally, we need to promote commercial products from sustainably managed resources of agricultural or animal origin. A more ecology-centred approach can only benefit the current situation, raising awareness and building the knowledge necessary for progress and further practical intervention.

f) **Feeding honeybee colonies: best practices:** Beekeeping is an ancient form of animal husbandry. However, when compared with other modern livestock or crop production systems, it is far behind in its use of technology. As part of the agricultural sector, which is an integral part of food production systems, beekeeping supports jobs in rural communities and inherently promotes sustainable farming practices.

It is paramount that governments promote measures that can develop it further to strengthen resilience. One way to do this is by creating synergies between the beekeeping sector and other farming industries, especially crop production since this directly influences the well-being of honeybees and their foraging sources.

6.1.4 Pillars for help beekeepers in rural areas

There are main four pillars of support and help beekeepers in rural areas sustain healthy colonies: 1) promotion of sustainable and diverse farming practices, 2) promotion of knowledge sharing and communication centers, 3) establishment of procurement infrastructures, and 4) establishment of a crisis (e.g. extreme weather) framework.

1) **Promotion of sustainable and diverse farming practices:** Farming practices directly influence honeybee health and nutrition. Farmers must try to reduce their use of insect pesticides where possible. Planting flowering species in field margins increases forage. These practices are especially relevant for tree and fruit crops. Ground vegetation creates a rich and diverse source of nutrients for all pollinators and also increases overall colony yields. Furthermore, cultivating flowering hedges around the fields helps to avoid the spread of hazardous pests through crops, while also increasing the forage available to pollinators. Such practices are already being implemented in several European countries such as the Germany, Portugal and the United Kingdom.

2) **Promotion of knowledge-sharing and communication centres:** One main obstacle to good beekeeping is the lack of circulation of up-to-date knowledge on changes in the industry. Promoting local beekeeping associations and organizations aids the dissemination of information on better feeding practices to all beekeepers. Such organizations should have a top-down approach. Central/national beekeeping organizations could curate the latest scientific information on bee nutrition and relay this to beekeepers in a digestible format. They could also execute quality control of feed on the market, which is currently not strictly regulated. In addition, these associations could send local climate and blooming details to their local networks advising them of forage conditions and when to feed the colonies with supplements. Some create a local blooming calendar, which helps beekeepers proactively plan their apiary management for upcoming foraging season.

3) **Establishment of procurement infrastructures:** One problem we have seen in beekeeping communities is purchasing beekeeping goods at a competitive price.

Having a central organization, like a cooperative, that can bring together feeding products for several beekeepers, would help manage costs. Syrup quality can also be better controlled by larger entities.
Cooperatives are useful for centralizing purchases and selling agricultural beekeeping products like honey to different markets. Without such infrastructures, some farmers might be restricted to their local markets and have extra difficulties in exporting their products. Several small farmers cooperating have more strength than just one big farmer.

4) **Establishment of a crisis framework:** When there are forest fires, extreme flooding, or heatwaves, all these result in beekeepers struggling to keep their hives healthy, and thus these require government support. There are some countries that have established a beekeeping crisis framework where beekeepers have access to highly subsidized feed products to nourish their hives. When a similar event occurs, the farmwork can be reactivated so that local beekeeping organizations can rapidly allocate feeding products to hives in need. Similar action has been taken in France, Italy, and Spain, and it is a lifeline for beekeepers in times of crisis. Such action can also be adapted in cases of extreme flooding or heatwaves.

ANNEXES:

Annex 1: List of consulted stakeholders

LIST OF INTERVIEWED DISTRICT OFFICIALS, PRIVATE SECTOR, NGO'S & COOPERATIVES(KII)

Kamonyi District

1. Madam Mukamana Leatitia: Director of the Business Development Unit in Kamonyi District.
2. Evangeline Muhire Coordinator of AVSI in Kamonyi
3. Janvier: Beekeeper from a local association in Kamonyi.
4. Agronomist Alex in Kamonyi
5. Ferdinand Veterinarian of Kamonyi District
6. Tugirimana Alexandre: President of the cooperative CODA JYAMBERE MUVUMVU in Kamonyi.
7. Iraguha Lauren: Private Sector Rwanda (PSF) representative in Kamonyi

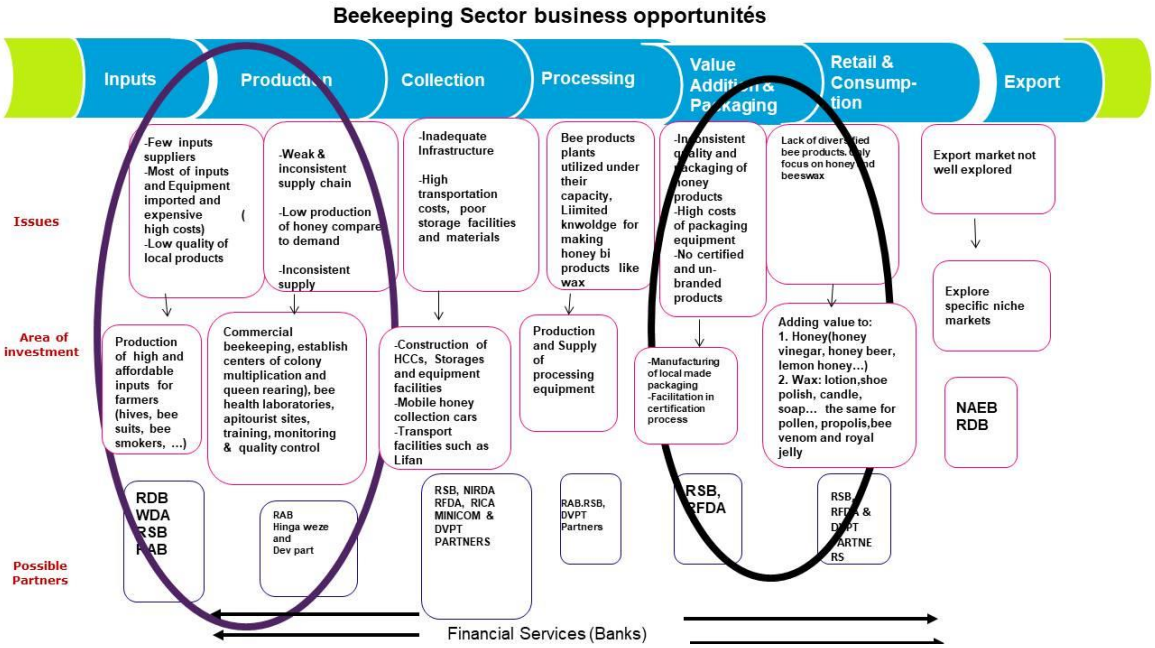
Gatsibo District

8. Madam Vestine Uwamaria: Director of the Business Development Unit in Gatsibo District.
9. Valens Hitiyaremye: Veterinarian in Gatsibo District.
10. Vincent Niyonzima: President of the cooperative Coporomi in Gatsibo

Nyabihu District

11. Smes and Cooperative Development Officer-Mr.Hatagaimbabazi Theodore
12. Animal Resource Officer-Eugene Shingire
13. Investment, Promotion, and Financial Services Officer-Karibushi Pierre Celestin
14. Startup Development Officer-Mr. Munzuyarwo Pierre Celestin
15. Employment Officer-Mr. Nsegiyumva Emmanuel
16. PSF President of Nyabihu District-Mr. Twagirayezu Dan

Annex II: Beekeeping Sector Business Opportunities



Annex III: List of Beekeeping Cooperatives and Companies

No	Name of cooperatives	Location	Contact person
	KIGALI CITY		
1	FERWACAPI		
2	SEZIBERA Jean Nathan		0788536778
3	Bernard NTAGANDA		0788454973
	WESTERN PROVINCE		
4	**UNICOAPIGI (3 cooperatives)**		0786909481
5	COABUMUCYA	Cyanzarwe	0783217917
6	INDAHEMUKA		0784466674
7	CODASE	Bigogwe	0786569853
7	**NBCU (Nyabihu Beekeeping Cooperative Union) :7 cooperatives**		
8	COAKOBKA Joseph	Nyabihu	0788840069
9	COAJEM	Nyabihu	0784456424
10	ABADASIGANA	Nyabihu	0783228063
11	COEAP	Nyabihu	0788942339
12	TWIHANGIRIMIRIMO	Nyabihu	0781866953
13	TURATIBIRUNGA	Nyabihu	0788877281
14	COIKA AMAVUBI	Nyabihu	0782015431
15	Gishwati Beekeeping Cooperative	Nyabihu	0786285913
	NORTHERN PROVINCE		
17	COAREVO	**Burera**	0787433444
18	ABAKUNDINZUKI	**Musanze**	0786364791
19	COOPACY	**Burera**	0783706808
20	COOPASK	**Burera**	0789543976
21	KOABAMU	**Gakenke**	0784019048
22	KODURU	Gakenke	0782725829
23	COOP TWIGIRE TWORORE	**Gakenke**	0785233160
24	Cooperative Wikwiheba	**Rulindo**	**0785992150**
25	COOSOBU	**Rulindo**	0783198754
26	COYIMABU	**Rulindo**	0783142017
27	COOP y'abavumvu ba Bwisige (COABWI)	**Gicumbi**	0782708148
28	ABAYAMBANA	**Gicumbi**	0787235100
29	KUNDUBUKI	**Gicumbi**	
	SOUTHERN PROVINCE		
30	ABIRU	**Muhanga**	0788873384

31	ZAMUKAKANYANA	**Muhanga**	0784358627
32	MPAMBI	**Muhanga**	0785990416
33	URWIRU	Muhanga	0783020650
34	KOPABUHU	Huye	0783627443
35	KOPABUKA	Huye	0785300158
36	**IMBEREHEZA**		0780651382
37	ABADATINYIMBORI		0788899691
38	COPAGA	Nyamagabe	0785238195
39	IMBONEZAMUTSAMA	Nyaruguru	0782319363
40	ABUZUBUMWE		0782319363
41	COODURU	Nyaruguru	0782200832
42	Intimirwa	Nyaruguru	0783131007/ 0784067841
43	KOAKA	Nyaruguru	0783659377
	EASTERN PROVINCE		
44	**Cooperative of beekeepers**	Nyagatare	0783341007
45	KOPANYAKA	Kayonza	0788949597
46	KOPAKI	Kirehe	0783546208
47	KOPROMI	Gatsibo	0783790368
48	MARO		0783328907
49	COBONZUGA	**Nyagatare**	
50	COYAMUKA	**Nyagatare**	0786320712

REFERENCES

1.Ahmad, F., Joshi, S.R. & Gurung, M.B. 2007. Beekeeping and rural development. Kathmandu, International Centre for Integrated Mountain Development (ICIMOD).

2. Aizen, M.A. & Harder, L.D. 2009. The global stock of domes¬ticated honey bees is growing slower than agricultural demand for pollination.

3. Bee Informed Partnership. 2020. Average Varroa per 100 Bees: From APHIS Survey During 2020. In: APHIS Honey Bee Survey Reports.

4. Belgium, Federal Agency for the Safety of the Food Chain. 2018. Advice 18-2018 of the Scientific Com¬mittee of the FASFC regarding the risk to bee health of contaminated and adulterated beeswax.

5. Brodschneider, R. & Crailsheim, K. 2010. Nutrition and health in honey bees. Apidologie, 41(3): 278–294.

6. Buawangpong, N. and M. Burgett 2019. Capped Honey Moisture Content from Four Honey Bee Species: Apisdor¬sata F., Apis florea F., Apis cerana F., and Apis mellifera L. (Hymenoptera: Apidae) in Northern Thailand. Journal of Apiculture 34: 157-160.

7. Büchler, R. & Uzunov, A. 2017. Honey bee selection. In P. Kozmus, B. Noc & K. Vrtacnik, eds. No bees, no life, bee¬books zaloznistvo in promocija.

8. Caleb Kiplimo Bett, Factors Influencing Quality Honey Production,International Journal of Academic Research in Business and Social Sciences 2017, Vol. 7, No. 11, ISSN: 2222-6990

9. European Commission: Overview of the EU honey market; http://ec.europa.eu/agriculture/markets/index_en.htm.

10. FAO: Honey Marketing and International Trade

11. FAO: Good beekeeping practices for sustainable apiculture

12. Liam Pippinato et Al.: Sustainable Niche Market, Department of Agricultural, Forest and Food Sciences (DISAFA): How Does Honey Behave? University of Turin, 10095 Grugliasco, Italy http://ResearchID.co/rid17458

13. MINAGRI, Honey Strategic Plan 2022-2032

14. MINICOM, Honey Cluster Development Strategic Plan

15. Nsekanabanzi SamsonAnaNsengiyumva Jean Nepo Analysis of the profitability of honey production in Nyamagabe District in Rwanda.

16. SNV, Beekeeping and Honey Value Chain financing Study Report, 2009
17. UNDP, Development of Inclusive Markets in Agriculture and Trade (DIMAT): Value Chain Analysis (VCA) of theHoney Sub-sector in Uganda, 2012

Visited Website
18. https://www.fortunebusinessinsights.com
19. https://rb.gy/wrdsf
20. https://oec.world/en/profile/bilateral-product/honey/reporter/rwa

Other consulted Policy documents, regulations and other relevant documents (https://shorturl.gg/HpYpMO)

21. Sustainable Development Goals | United Nations Development Programme
22. National Strategy for Transformation (NST1)
23 . PSTA4 Rwanda Strategic Plan for Agriculture Transformation
24. National Agriculture Policy
25. Leveraging Private Sector Strategy
26. FAO Good beekeeping practices for sustainable apiculture
27. Developing Community based tourism, GIZ report, 2021.
28. Beekeeping/ honey Value chain financing study report. NV report May 2009
29. Entrepreneurship Development Policy (EDP)
30. Good bee keeping practices: practical manual on how to identify and control main diseases of the Honeybee (Aps mellifera). TECA publication, 2018.
31. NISR-National Institute of Statistics of Rwanda Labour force Survey2018, 2022.
32. African Organic; agriculture Training manual 2018.
33. International articles on honey landscaping economic, social, and structural factors constraining inclusive job growth and creation for decent employment in Rwanda