Journal of Economics and Sustainable Development
ISSN 2222-1700 (Paper) ISSN 2222-2855 (Online)
Vol.16, No.3, 2025

Identification of Factors Affecting Sustainable Smallholder Honey Production and Export Performance Across the Value Chain in Addis Ababa

Rodas Yemane Tesfamicael[1], Hanan Hussein Awad Mohamed[2*], Saif Al-Din Ehab Ali [3]

[1] *School of Business, Windsor University, US.*
[2] *School of Environment, Resources and Sustainability, University of Waterloo, Canada.*
[3] *Department of Data Science and Artificial Intelligence, University of Waterloo, Canada.*

[*] *Corresponding author's e-mail: hmohamed@uwaterloo.ca*

ABSTRACT
Research shows a frustrating paradox in Ethiopia's honey sector. The beekeeping industry faces challenges exporting products because of climate stressors, poor processing, traceability issues, and fragmented markets. The paper introduces the Sustainability-Trade Barrier-Economic Constraint Model (STB-ECM), which helps to analyze the beekeeping industry through multiple lenses, including environmental, social, and economic factors, as well as the trade barriers and economic bottlenecks that limit international market access. The literature review and initial assessments identified thirty factors and narrowed them down to 16 key factors using the Analytical Hierarchy Process (AHP) and Interpretive Structural Modelling (ISM). The analysis revealed that export price stagnation stems from increasing domestic consumption, adulteration, illegal trade, and inconsistent eco-friendly processing. The lack of credit access and processing capacity due to economic constraints hinders international expansion. The framework provides analysis and practical solutions to promote fair trade, sustainability, improved market access, and global competitiveness. The paper integrates these methodologies to guide policymakers and identify opportunities to foster sustainable growth in honey exports.
Keywords: Honey Production; Export Performance; Sustainability Factors; Apicultural Value Chain; Trade Barrier; Export Policies; Sustainability-driven Policies.
DOI: 10.7176/JESD/16-3-07
Publication date: May 30th 2025

1. Introduction

Honey enhances food security, biodiversity, and farm stability, making it essential to ecological systems (Herreros & Ali, 2023). The global honey market was valued at USD 9.01 billion in 2022 and is expected to grow at a compound annual growth rate (CAGR) of 5.3% from 2023 to 2030. High demand for nutritious food products and growing consumer health awareness drive this market growth (Grand View Research, 2025). Unfortunately, inefficiencies throughout manufacturing and export chains are undermining its potential. Those seeking financial returns and environmental benefits need systematic approaches (Haddad, Ariza, & Malmer, 2021). For small farms, beekeeping provides income opportunities, fosters cooperatives, and supports community development—it is low-stress, high-impact, and environmentally enriching (Nico & Christiaensen, 2023; Prodanovič et al., 2024).

The honey-producing potential of Ethiopia is vast because the country holds many natural resources. However, its honey industry has not developed due to insufficient infrastructure, regulatory constraints, and underinvestment in sustainable value chains. The sector faces underdevelopment because of limited investments toward sustainable beekeeping, strong value chains, legal frameworks, infrastructure, and market access. The increasing demand for natural, ethically produced honey (Bose & Padmavati, 2024) drives the development of environmentally friendly apicultural chains. The true path to sustainability requires environmental protection, fair trade practices, and pollinator protection measures (Beck-O'Brien & Bringezu, 2021). The relationship between honey production and circular economy principles offers sustainable growth opportunities, as noted by Isabirye (2023). The World Food and Agriculture (2022) reports that Ethiopia exported only 37 metric tons of honey in 2022, which shows major supply chain problems. Eco-friendly practices with fair resource management and trade standards face significant challenges because of insufficient infrastructure, market limitations, and certification challenges. (Urugo, Tola, Kebede, & Ogah, 2024; Tafesse, et al., 2021). Our research presents a market-based sustainability model to unlock Ethiopia's untapped bee resources while building economic value and resolving present market challenges.

The value chain in Addis Ababa lacks a comprehensive environmental assessment, though certain aspects of Ethiopia's honey trade have been previously examined. A triple-bottom-line perspective—incorporating social, financial, and environmental factors—enhances sector value. This study employs the Analytical Hierarchy Process (AHP) and Interpretive Structural Modelling (ISM) to evaluate the influence of sustainability on honey production and exports. A hypothesis-driven approach is essential for improving data quality and strengthening the industry's competitive advantage.

Research Objectives

1. **Analyze and categorize the environmental, economic, and legal sustainability constraints that influence the honey value chain in Ethiopia**.

- *Hypothesis (**H1**):* Honey exports are predominantly constrained by insufficient quality control measures and regulatory inefficiencies.

2. **Employing ISM analysis to elucidate the interdependencies and identify the causal linkages among the various factors contributing to sustainability.**

- *Hypothesis (**H2**):* Of greater significance than the inefficiencies inherent in manufacturing processes are the structural influences on exports that arise from market-related constraints, such as robust local demand and the imperative of price competitiveness.

3. **Examine the sustainability of export competitiveness in projects that encompass modern processing, certification, and climate-resilient beekeeping practices.**

- *Hypothesis (**H3**):* Adhering to international organic standards and implementing robust traceability systems will enhance access to high-value markets.

4. **4. Formulate an export strategy prioritizing sustainability, ensuring legislators and business leaders are at the forefront of impactful initiatives**.

- *Hypothesis (**H4**):* Strategic policy modifications, targeted investments throughout the value chain, and a deliberate integration of financial incentives are poised to enhance the performance of honey exports.

Research Questions

Primary Research Question

What factors related to sustainability, such as environmental, financial, and regulatory challenges and strategic initiatives to enhance global competitiveness, may affect Ethiopia's honey production and export capabilities?

Sub-Questions

1. What are the principal legal, financial, and environmental obstacles that influence the performance of Ethiopia’s honey exports?
2. How do these barriers interact with each other in the context of the honey value chain?
3. To what extent do contemporary processing methods, sustainable beekeeping practices, and legal reforms enhance the competitiveness of honey exports?
4. To what extent has Ethiopia’s honey marketability been influenced by sustainability-driven policies, including fair-trade certification, quality control, and traceability?
5. What policies and investment initiatives might enhance technical adoption and improve financial accessibility for small-scale honey producers?

Scope of the Study

The research focuses specifically on Addis Ababa, which serves as Ethiopia's central hub for honey exporters, farmers, and industry experts. This research provides an extensive analysis of value chain opportunities and sustainability challenges in this region based on the work of Tegegne, Feye, and Gebre-Egziabher (2020). The research provided real-world solutions that can support key stakeholders involved in Ethiopia's honey value chain, from government officials to producers and exporters. The ultimate goal is to highlight ways to build a stronger, more resilient industry to expand Ethiopian honey internationally.

The research aimed to identify the links between honey production and movement in the Ethiopian value chain and international buyer expectations for sustainability. The research helps position Ethiopian honey producers to compete more effectively in the global marketplace by understanding these connections (Global Market Access Programme (GMAP), 2023).

CONCEPTUAL BACKGROUND

Theoretical Framework

The research uses Porter's 1985 Value Chain Model and Elkington's 1998 Sustainability Triple Bottom Line Framework to analyze Ethiopia's honey production and export dynamics. These models highlight scientific approaches to improve trade and financial gains while addressing sustainability limitations.

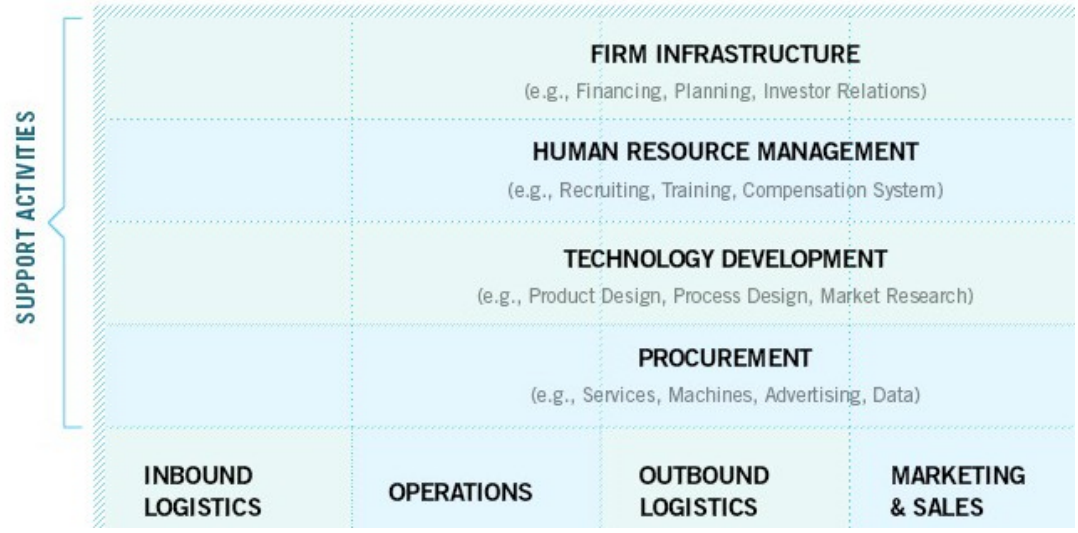

Figure 7 Michael Porter's value chain framework (Institute for Strategy and Competitiveness, n.d.)

Sustainability Triple Bottom Line (TBL) Framework

The TBL framework evaluates industry sustainability by examining three distinct elements: environmental, financial and social. The environmental health of the industry is measured through waste levels, pollinator diversity, and wildlife conservation, while climate resilience provides additional assessment. Economic sustainability includes revenue power, market expansion, competitive pricing, infrastructure growth, and value-added prospects such as therapeutic honey and propolis. Social sustainability depends on fair trade, income equity, capacity building, smallholder support, and gender inclusion. The TBL framework combines market edge with sustainability principles to develop a comprehensive plan to elevate the Ethiopian honey industry.

Porter's Value Chain Model

The Porter Value Chain Model reveals critical bottlenecks in the Ethiopian honey industry, which include production, processing, distribution and export stages and reveals major inefficiencies. This approach makes intervention tactics more precise to enhance market position and value chain flow. Table 1 restructures Porter's framework by integrating sustainability throughout the value chain.

Table 14 Adapted Honey Production and Export Value Chain

Primary Activities	Challenges in Ethiopia's Honey Industry	Sustainability-Driven Value-Adding Activities
Inbound Logistics	Limited availability of modern beekeeping implements and insufficient sustainable materials for hive construction	Securing financial resources for environmentally sustainable beekeeping equipment
Operations (Processing and Production)	Conventional approaches, established norms, absence of traceability, and insufficient quality assurance	Contemporary advancements in refining methodologies have been embraced, alongside attaining organic certification.
Outbound Logistics	Insufficient supply chains and substandard cold storage facilities.	Centres for institutionalizing and centralizing quality assurance use blockchain technology for better traceability.
Marketing and Sales	The company faces two significant challenges: weak branding and limited market reach.	Promote Ethiopian honey as a premium, organic, and eco-friendly product, supported by effective after-sales service.
After-Sales Services	Insufficient collaborative assistance and inadequate education for producers.	The lack of educational programs for producers and insufficient cooperative support demonstrates an urgent requirement for financial aid targeting small-scale beekeepers.

Sustainability in Honey Production

Herreros and Ali (2022) state that honey production links food security with rural strength and wildlife protection. Habitat expansion with chemical elimination as a combination promotes sustainable apiculture practice and fighting against the effects of climate change. Organic beekeeping benefits from IPM practices with top-bar and Langstroth hive systems, which reduce synthetic insecticide usage and enhance colony health. Habitat preservation initiatives result in native plant revival, promote agroforestry practices, and establish pollinator-friendly zones. The ApisProtect and Inmarsat climate-smart hive management collaboration from 2019, combined with drought-resistant feed crops, improves overall resilience. The global market position of Ethiopia gains strength through fair-trade certification and geographic branding which receives support from Fairtrade International (2019) and UNIDO (2024) (ApisProtect & Inmarsat, 2019; Modern Farmer, 2022; Fairtrade International, 2019; UNIDO, 2024).

Value Chains and Sustainability

The Value Chain Model of Porter which has traditionally focused on efficiency now could incorporate sustainability by emphasizing environmental care and social equity and economic grit (Linkov, et al., 2020). The honey value chain in Ethiopia suffers from outdated technology and unstable infrastructure and weak rule of law (The IGAD Biodiversity Management Programme, 2016). Sustainability implementation requires immediate action in the following five phases:

1. **Input Supply and Hive Management** – Managing input supply and hive operations, especially with sustainable products and educational courses, demands keen awareness of climatic factors.

2. **Honey Production and Harvesting** – Employ appropriate conditions and effective extraction methodologies tailored for pollinators to yield and gather honey.

3. **Processing and Quality Control** – The implementation of traceability systems together with adherence to internationally recognized organic standards such as EU Organic, USDA Organic, and Fairtrade, notably enhances both processing efficiency and quality assurance.

4. **Distribution and Market Access** – Enhancing collaborative networks, fostering ethical financial practices, and reinforcing cooperative frameworks to help overcome distribution challenges and improve market accessibility.

5. **Consumer Engagement and End-Use** – The focus on value-added products and circular economy initiatives demonstrates the significance of consumer participation and product utilization at the final stage.

Global Honey Market Trends and Sustainability Challenges

Manuka and Sidr honey represent two environmentally sustainable varietals in the global marketplace. The long-term pursuit of profitability encounters sustainability problems such as deforestation, monoculture cultivation, excessive pesticide use, and climate change (FAO, 2022).

Small-scale farmers experience restricted market entry because strict pesticide residue regulations and certification costs are expensive. The lack of adequate cold-chain logistics and quality control laboratories creates additional barriers to commodity sales, which reduces Ethiopia's ability to compete globally.

Ethiopian Honey Production and Uses

The country stands as Africa's leading honey producer because it contains many floral species across different agroecological zones (Dekebo, Bisrat, & Jung, 2019). Honey is an important product in the Ethiopian food and medicine industry, but its production is constrained by market access problems, environmental degradation, and inefficient production systems (Gebremedhin, 2020). Hunde (2025) states that sustainable farming practices and biodiversity protection will drive development. Export competitiveness suffers from limited traceability systems, strict organic certification requirements, and habitat degradation caused by climate change (Hendricks, 2021).

Regional Variations in Ethiopia's Honey Value Chain

The honey value chain in Ethiopia shows apparent spatial differences (Feleke, 2025). Southwest Ethiopia operates through cooperative value chains, but inconsistent results occur because of processing and logistical challenges. Adopting a basic model for production efficiency creates market exclusion for small-scale enterprises in Oromia because they cannot access premium markets. The localized inequalities must be addressed to achieve equitable sector expansion and long-term viability (Addisu, 2011).

Research Gaps

Examining Ethiopia's honey value chain is increasingly crucial, despite persistent uncertainties:

- **Urban Honey Markets** – Analyzing market dynamics surrounding quality honey, mainly for export, reveals a significant gap in scholarly research on urban honey value chains in Addis Ababa.

- **Comprehensive Value Chain Analysis** – The primary focus of alternative investigations has been on individual constraints, rather than a complete examination of interdependencies among production, processing, and exporting activities.

- **Market, Infrastructure, and Policy Interdependencies** – The research continues to investigate the potential links between legal frameworks, infrastructural challenges and market accessibility.

- **Sustainability-Centred Research** – The current research on fair trade practices, pollinator-friendly policies, and climate-conscious beekeeping appears to be insufficient to emphasize the crucial aspect of sustainability.

Unique Contributions of This Study and Research Gap Addressed

This research extends previous work by using multi-criteria decision analysis (AHP-ISM) to systematically identify and prioritize constraints that evaluate sustainability and export restrictions:

1. **Systematically Identify and Rank Constraints** – Employs AHP rankings to assess sustainability and delineate export barriers.

2. **Map Structural Relationships** – The ISM modelling framework establishes causal relationships among environmental, economic, and legal constraints.

3. **Develop the Sustainability-Trade Barrier-Economic Constraint Model (STB-ECM)** – A structured approach that contemplates the intersection of trade limitations and ecological dilemmas.

4. **Empirical Benchmarking** – The empirical benchmarking of Ethiopia's honey sector seeks to identify best practices compared to leading exporters such as Argentina, China, and New Zealand.

Prior investigations into Ethiopia's honey sector have examined beekeeping methods (Gratzer, Wakjira, Fiedler, & Brodschneider, 2021), trade regulations (UNCTAD, 2020), and value chain inefficiencies (Kassaye, Shao, Wang, & Belete, 2022) from a fragmented perspective. The framework, incorporating legal, environmental, financial, and technical elements, is still lacking. This paper presents a data-driven approach to move the honey sector of Ethiopia from a low-margin commodity model to a high-value branded product model to close a critical gap and ensure sustained competitiveness and viability.

2. Materials and Methods

Study Design and Workflow

The Sustainability-Trade Barrier-Economic Constraint Model (STB-ECM)

The research employs a Sustainability-Trade Barrier-Economic Constraint Model (STB-ECM) to examine the complex relationships between sustainability challenges, trade restrictions, and financial constraints affecting honey exports from Ethiopia. The model integrates three main dimensions:

1. **Sustainability Factors –** Honey production is affected by sustainability, which encompasses environmental, social and economic dimensions. Production efficiency and global market appeal are reduced by climate change, pollinator decline, certification constraints and weak sustainability branding (Hendricks, 2021).

2. **Trade Barriers –** Market access and competitiveness face significant challenges due to trade limitations stemming from weak market connections, insufficient quality control frameworks, and the lack of equitable trade and traceability systems (Goshme & Ayele, 2020). These factors limit Ethiopia's ability to enter premium global honey markets.

3. **Economic Constraints –** Producers and exporters face increased challenges in scalability and profitability because limited funding availability, technological inefficiencies and value chain bottlenecks create additional constraints (Liverpool-Tasie et al., 2020).

The STB-ECM provides a systematic approach to show how environmental challenges affect trade competitiveness and create economic hardships. It is an important tool for identifying leverage points to inform strategic interventions such as pesticide-free zones, climate-resilient beekeeping, blockchain-based traceability, and financial mechanisms like microfinance and centralized processing hubs.

Study Workflow

The research employs a structured workflow (see Figure 2) to systematically evaluate Ethiopia's honey export performance. This approach integrates analytical methods with empirical validation, ensuring a robust methodology.

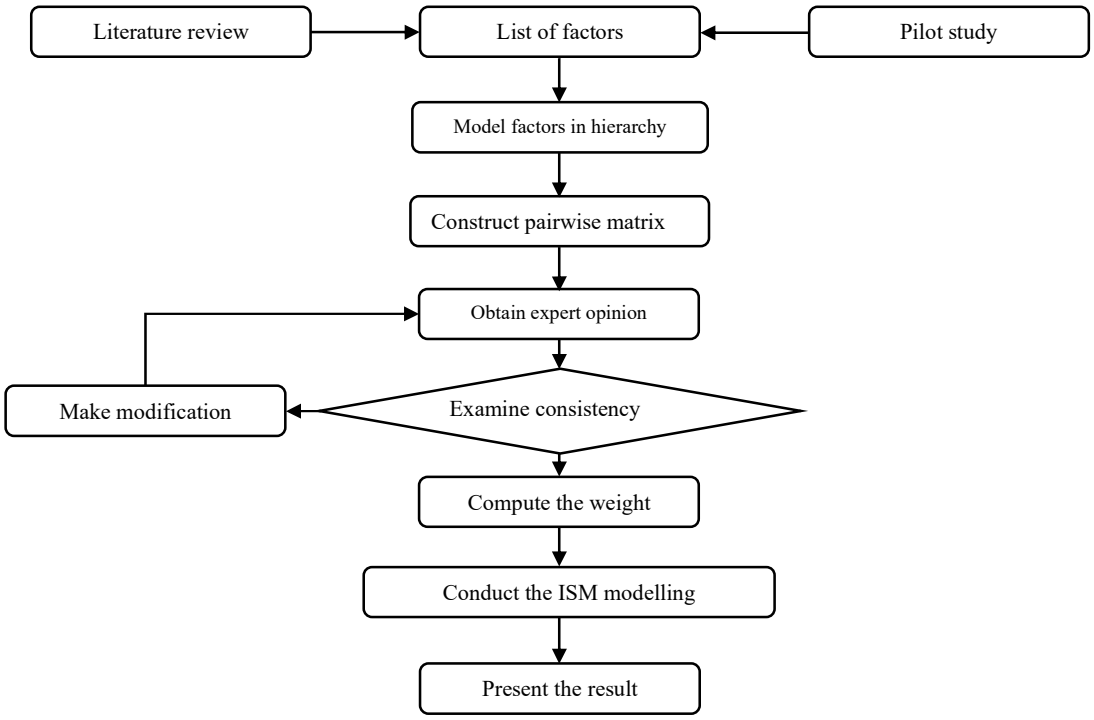

Figure 8 Research Workflow

Methods Employed and Justification

The research combines qualitative diagnostic methods with multi-criteria decision analysis (MCDA). The methodology follows international sustainability benchmarks, including United Nations Sustainable Development Goals (SDGs) for practicality and relevance. The research uses two primary analytical methods which include the analytical hierarchy process (AHP) and interpretive structural modeling (ISM):

1. **Analytic Hierarchy Process (AHP) –** The Analytic Hierarchy Process (AHP) methodically evaluates sustainability constraints via expert pairwise comparisons, ensuring objective prioritization of key industrial challenges (Tavana, Soltanifar, & Santos-Arteaga, 2023). The research applies AHP to assess sixteen sustainability factors that impact honey production, processing, market access, and regulatory compliance.

2. **Interpretive Structural Modelling (ISM) –** ISM provides a systematic approach to understand complex interconnections within a framework by revealing hierarchical relationships and governing structures of interactions (Abbas, Mehdi, Azad, & Frederico, 2022). The ISM charts on environmental constraints distinguish primary root causes from secondary effects and highlight systematic inefficiencies tied to climate change, legal framework deficiencies, fiscal constraints, and regulatory ambiguities, thereby enabling structural enhancements.

Comparative Analysis: Benchmarking Against Global Honey-Exporting Nations

The findings presented in Table 2 derive from a benchmarking study which strategically evaluates Ethiopia's honey sector through comparisons with leading international honey producers:

Table 15 Benchmarking Against Successful Honey-Exporting Nations (Grand View Research, 2025)

Country	Annual Honey Export Volume (MT)	Key Sustainability Strategies	Competitive Advantages
Argentina	75,000	• Large-scale organic honey production, • Traceability systems	• Strong price competitiveness, • High global demand
China	120,000	• Industrial-scale production • Cost leadership	• Low production costs • High production volumes ensure market dominance
New Zealand	17,000	• Manuka honey branding • Premium market positioning • Strict quality control	• Premium pricing • Niche market advantage
Ethiopia	37	• Limited certification • Weak processing and export infrastructure	• High local demand • Unique honey varieties

Geographical Focus

The main study site selection was for Addis Ababa because it is Ethiopia's central honey production, processing, and export hub. The urban environment provides better access to stakeholders, including beekeepers, cooperatives, exporters, legislators, and certifying agencies (Tadesse, 2019). The value chain of Addis Ababa includes processing, quality control, and compliance with international trade standards, which makes it suitable for studying honey export constraints and opportunities.

Urban Sustainable Honey Production Challenges and Innovation Opportunities

The urban honey value chains of Addis Ababa experience sustainability limitations because of limited processing capabilities, inadequate tracking systems, and poor logistics, which present opportunities for expansion (Tadesse, 2019). The combination of rooftop apiaries with vertical beekeeping practices in urban agriculture makes the most efficient use of land space while solar-powered extraction (Liverpool-Tasie et al., 2020) and biodegradable packaging improve ecological efficiency (Goshme & Ayele, 2020). Blockchain implementation enables traceability solutions which meet international import standards.

Sampling Strategy

A strategic non-probabilistic sampling method was used in the honey value chain of Ethiopia to collect a wide range of data (Stratton, 2023). The survey involved the views of sixty participants (Table 3), including government officials, honey exporters, producers (beekeepers and cooperatives) and regulatory/policy experts. This approach is in line with AHP methodology which is commonly used in agriculture to prioritize stakeholder's concerns and reconcile conflicting objectives such as market access, regulatory oversight and sustainability (Kumar & Pant, 2023), and to ensure that the outcomes capture policy effectiveness, traceability systems, and certification mechanisms, all of which are critical elements that AHP has evaluated in comparable agricultural decision-making scenarios.

Table 16 The Composition of The Sample, Including Responses From 60 Industry Experts Across Key Stakeholder Groups

Respondent Group	Total Respondents	Role in the Study
Honey Exporters	27	Analyzing trade regulations, market constraints, and export limitations enables researchers to better understand the fundamental mechanisms.
Producers (Beekeepers and Cooperatives)	16	Identify the shortcomings in production, the obstacles encountered during processing, the issues related to sustainability, and the limitations imposed by financial factors.
Regulatory and Policy Experts	9	Emphasize the environmental problems, the limitations of natural resources, the shortcomings of manufacturing standards, and the difficulties related to processing problems. Discuss the limited incorporation of fair-trade certifications, traceability mechanisms, and legislative reforms in the general framework.
Government Officials	8	Analyze the mechanisms of legislative oversight, the role of financial incentives, the application of quality benchmarks, the advancement of environmental initiatives, and other support frameworks.

Table 17 Response Rate

Respondents	Total questionnaires distributed	Successfully responded	Incomplete response	Incorrect response	Not responded
Exporters	30	27	1	1	1
Producers	20	16	2	1	1
Experts	10	9	1		
Gov't officials	10	8	1		1
Total	70	60	5	2	3
Percentage	100%	86%	7%	3%	4%

The 86% response rate (see Table 4) shows that the stakeholders have been involved well, which increases the credibility of these findings. This study incorporates real-world insights from key industry stakeholders to ensure that the boundaries and policy recommendations identified in this study are consistent with AHP-based research based on expert perspectives.

Data Collection and Analysis

AHP ranks sustainability constraints, while ISM maps interdependencies, revealing structural inefficiencies. Data collection comprises the following components:

- **Primary Data –** The approach uses structured questionnaires for key stakeholders and combines pairwise comparison matrices (AHP) with interdependency analysis (ISM).
- **Secondary Data –** Additional peer-reviewed literature, industry reports and trade policy documents support the research.

Data Validity and Reliability

Methodological strategies to ensure data robustness:

1. **AHP Consistency Validation:** A consistency ratio (CR) threshold of ≤0.1 ensures logical coherence in expert rankings.

2. **Delphi Method for ISM:** The process of iterative expert feedback enhances and refines the interpretations of systemic mapping.

3. **Triangulation Approach:** Combining primary expert insights with secondary trade data leads to more reliable results.

4. **Sensitivity Analysis for AHP Rankings:** The analysis employs Monte Carlo simulations with 1,000 iterations to evaluate ranking stability across expert weighting scenarios.

3. Results and Discussion

3.1 Key Factors Influencing Export Performance

The AHP findings (Figure 3; Tables 5 and 6) show that the main barrier to the improvement of the honey exports of Ethiopia is market-related. The study identifies three significant constraints, namely market accessibility, manufacturing efficiency, and regulatory governance, as the most important factors affecting export competitiveness and the adoption of sustainability.

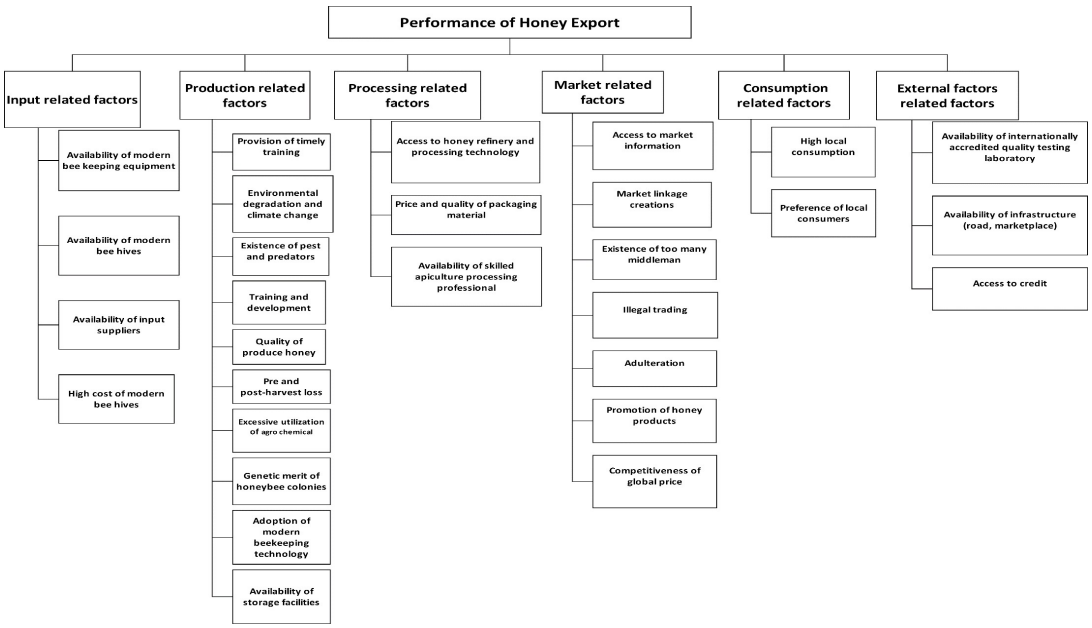

Figure 9 Hierarchical Structure of Factors

The AHP framework supports a systematic hierarchy of preferences, as shown in Table 5, which produces a reliable, unbiased ranking based on the comparative importance criterion. The scale uses numerical values to quantify qualitative judgments so decision-makers can accurately handle conflicting objectives between policy effectiveness, financial constraints, and export limitations. The scale ranges from “equal” 1 to “extreme” at nine while maintaining consistency and reducing bias through proper weighting. The organized approach establishes clear procedures which enable producers to base their decisions on data.

Table 18 Scale of Preference in AHP Analysis

Intensity of Importance	Definition	Explanation
1	Equal importance	Two factors contribute equally to the objective
3	Moderate importance	Experience and judgment slightly favour one factor over the other
5	Strong importance	Experience and judgment strongly favour one activity over the other
7	Extreme importance	Experience and judgment very strongly favour one over the other
9	Extreme importance	The evidence favouring one over another is of the highest possible order of affirmation.

The honey industry of Ethiopia encounters four main challenges, which include market restrictions, production inefficiencies, regulatory challenges and financial limitations, as presented in Table 6. These factors reveal systemic barriers that challenge sustainable production and global competitiveness.

Table 19 Key Factors Identified in The Study That Influence Sustainable Honey Production and Export in Addis Ababa

Market Constraints	High local consumption	The majority of Ethiopian honey is used for domestic consumption in low-cost, low-alcohol beverages like Tej, which restricts the potential for exports.
	Global price competitiveness	Ethiopian honey faces significant challenges in the international market mainly because of the complicated pricing system.
	Adulteration and illegal trading	Unregulated sales and honey adulteration significantly undermine market trust and diminish export potential.
	Limited market access and linkages	The tenuous links that exist between producers and international buyers inhibit growth.
Production Inefficiencies	Inadequate processing and storage facilities	The limitations on access to modern honey refining technology create significant challenges for export readiness.
	Environmental degradation & climate change	The bee populations are significantly impacted by deforestation, habitat degradation and climate change fluctuations.
	Low adoption of modern beekeeping practices	The reliance on conventional methods continues to reduce efficiency and sustainability.
	Training gaps in quality control	The producers do not have the necessary skills to meet the global export standards.
Regulatory & Governance Challenges	Weak enforcement of quality standards	The credibility of processes suffers from inconsistent quality control and unaccredited laboratories.
	Absence of fair-trade certification	The limited availability of certification programs hinders Ethiopian honey's entry into premium markets.
	Lack of traceability systems	The difficulties in tracking honey origins create significant challenges for following international import regulations.
Financial Barriers	Limited access to credit and investment	Small-scale beekeepers encounter major obstacles when obtaining the financial support needed for their growth initiatives.
	High cost of modern equipment	The high cost of modern beehives and extraction equipment creates a financial challenge that prevents numerous producers from acquiring these tools.
	Lack of government incentives	The restricted funding for environmentally responsible beekeeping creates significant obstacles for small producers because they need expensive equipment and have limited investment choices. The absence of government incentives makes sustainable practices less appealing for this essential sector.

The main elements affecting the honey export market of Ethiopia from the value chain perspective include input provision, manufacturing, processing, market accessibility, consumption and the cross-cutting issues. The limited access to modern beekeeping tools, high hive costs and inadequate inputs also hampers the production efficiency. The honeybee populations are threatened by environmental stressors such as climate change, deforestation and insect infestations. The low adoption of advanced technology and insufficient training reduce productivity and quality. The industry is also hindered by processing barriers such as the scarcity of refining technologies, shortage of skilled personnel and high packaging costs, which affect the industry's preparedness for international trade.

International trade faces multiple barriers due to weak producer-consumer links, excessive intermediaries, adulteration, and intense global price competition. Both local consumer preferences and domestic demand levels restrict the availability of exports for international trade. The situation becomes more difficult because of limited financing options, insufficient infrastructure, and the unavailability of accredited quality testing facilities. Ethiopian honey's export market development and global competitiveness improvement demand improved financial systems, enhanced regulatory controls, better infrastructure, and technical training.

Table 20 Factors Affecting the Export Market Across the Value Chain

1		Factor
F1	Input	Availability of modern bee-keeping equipment
F2		Availability of modern bee hives
F3		Availability of input suppliers
F4		High cost of modern bee hives
F5	Production	Provision of timely training
F6		Environmental degradation and climate change
F7		Existence of pests and predators
F8		Training and development
F9		Quality of the produce honey
F10		Pre-- and post-harvest loss
F11		Excessive utilization of agrochemicals
F12		Genetic merit of honeybee colonies
F13		Adoption of modern beekeeping technology
F14		Availability of storage facilities
F15	Processing	Access to the honey refinery and processing technology
F16		Price and quality of packaging material
F17		Availability of skilled apiculture processing professionals
F18	Market	Access to market information
F19		Market linkage creations

F20		The existence of too many middlemen
F21		Illegal trading
F22		Adulteration
F23		Insufficient export promotion strategies
F24		Promotion of honey products
F25		Competitiveness of global price
F26	Consumption	High local consumption
F27		Preference of local consumers
F28		Availability of internationally accredited quality testing laboratories
F29	Cross-cutting	Availability of infrastructure (road, marketplace)
F30		Access to credit

Structural Inefficiencies and Strategic Interventions

Interpretive structural models (ISM) (Figure 4) depict the coherent constraints that affect the performance of Ethiopia's honey exports. The hierarchical framework depicts the key interdependencies within the value chain and the critical bottlenecks that limit industry competitiveness, sustainability, and adherence to regulatory standards.

Table 21 Factors Weights

Factor	Weight
Price Competitiveness	0.18
Processing and Refining Gaps	0.15
Illegal Trading and Adulteration	0.14
Limited Access to Credit	0.12
High Local Consumption	0.10
Regulatory Enforcement Weakness	0.09
Market Linkages Deficiency	0.08
Lack of Traceability Systems	0.07
Environmental Degradation	0.05
Absence of Fair-Trade Certification	0.02

The primary constraint is price competitiveness due to inadequate regulatory oversight and poor data management practices. The small scale of the Ethiopian economy, combined with its high production costs, creates an unfavourable market position for the country compared to Chinese and Argentine producers who have

lower costs.
The combination of processing difficulties with efforts to reduce inequality creates major problems because of the different USA–EU quality standards that block access to high-end markets. The market reputation of Ethiopia suffers from lax oversight of illicit trade and honey adulteration, which also damages financial stability. The absence of fair-trade certification prevents Ethiopian honey from entering premium organic markets. Small-scale beekeepers face substantial credit limitations which prevent them from investing in processing improvements and obtaining necessary certifications. The large domestic market consumption reduces the available exportable surplus, limiting Ethiopia's ability to maintain stable international market presence. EU and North American import standards cannot be met because there is no proper regulatory oversight and traceability systems which blocks potential market growth.

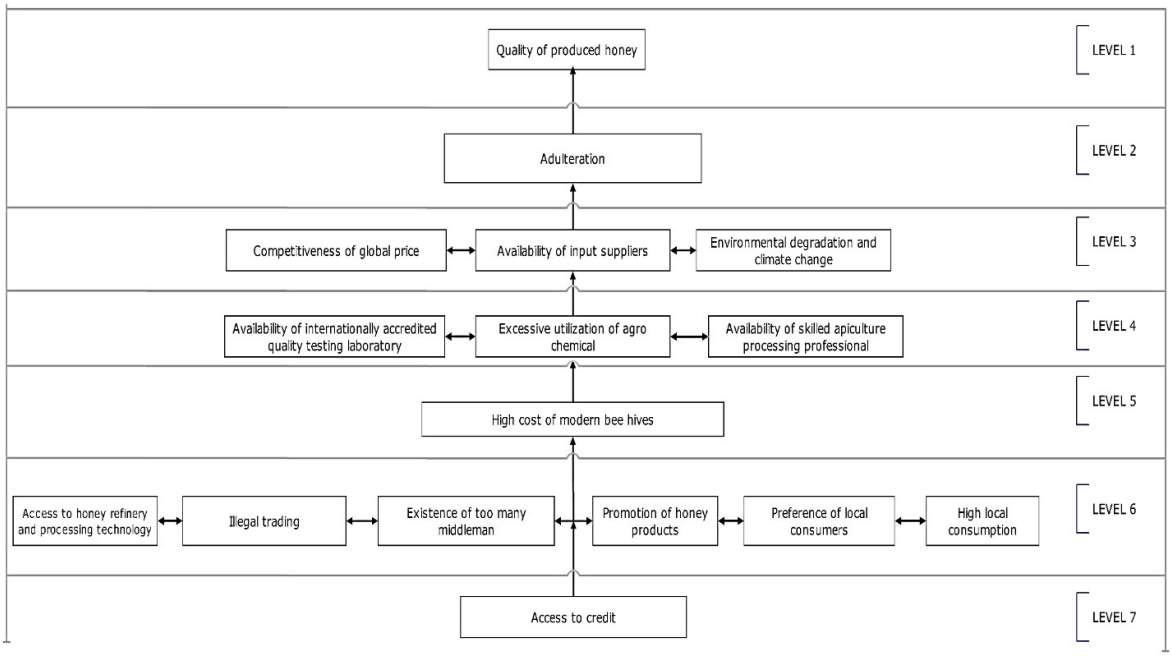

Figure 10 The Final Results of ISM Analysis

Sustainability Constraints and Interdependencies in Ethiopia's Honey Value Chain

The causal relationships among sustainability constraints, trade barriers, and export performance are further visualized in Figure 5, the causal flow diagram illustrating key interdependencies among climate, production, regulatory, and financial constraints influencing export competitiveness in Ethiopia's honey value chain. The diagram maps how climate change, pesticide use, certification barriers, and access to finance interact and affect quality control, modern processing, and traceability systems, ultimately determining export outcomes. The figure maps the directional influence of each variable. It highlights how root causes such as climate change and deforestation cascade through financial and regulatory systems to impact export competitiveness. Traceability, certification, and modern processing emerge as central leverage points for intervention. These linkages are decoded thematically in **Table 8**, which explains the numbered relationships between the variables. The diagram and table offer a comprehensive map of systemic inefficiencies and leverage points across the honey value chain.

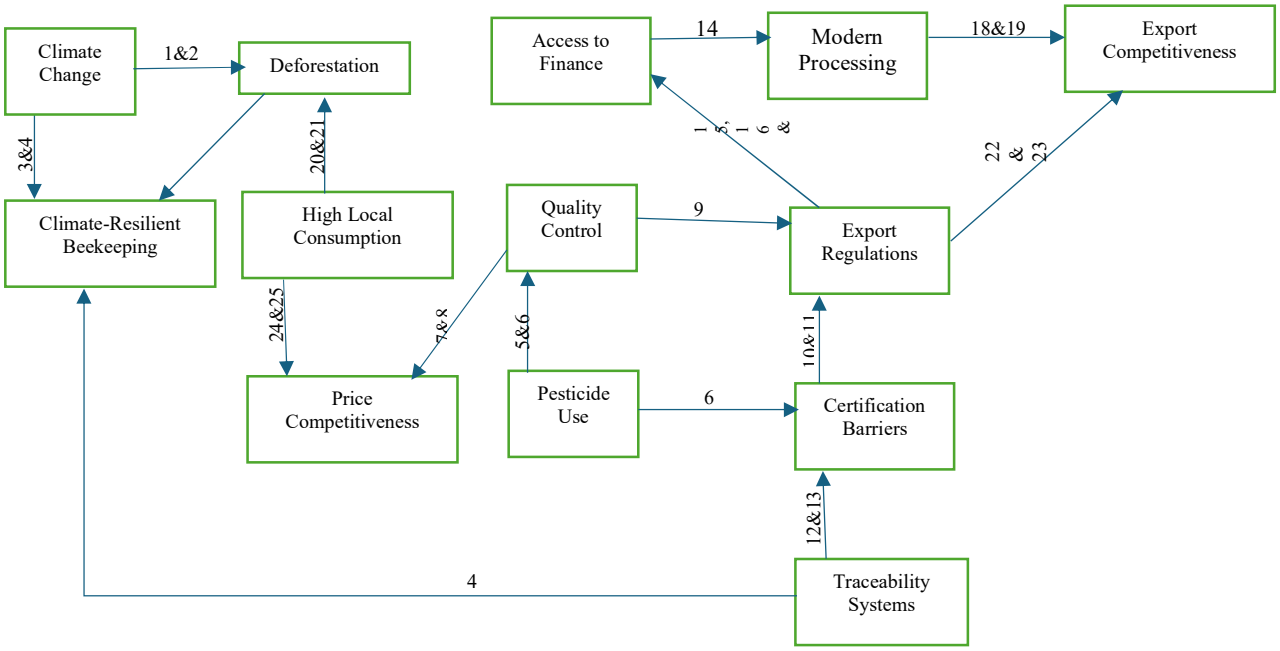

Figure 11 Causal flow diagram illustrating key interdependencies

Table 22 Interrelationships underlying key variables in the Ethiopian honey value chain

Interrelationships	
1. Environmental dependencies	**13.** Certification compliance
2. Environmental degradation	**14.** Financial support for modernization
3. Adaptation strategies	**15.** Regulations influencing financial access
4. Adaptive response	**16.** Investment requirement
5. Pesticide impact on quality	**17.** Policy-driven financing
6. Chemical contamination	**18.** Improved processing benefits exports
7. Quality affecting pricing power	**19.** Value addition
8. Product differentiation	**20.** Environmental impact on market demand
9. Regulatory inefficiencies	**21.** Resource scarcity impact
10. Certification affecting exports	**22.** Policy influences on exports
11. Compliance hurdles	**23.** Trade facilitation
12. Improved oversight	**24.** Market constraints affecting pricing
	25. Market pressure

DISCUSSION

The study shows that structural market barriers, inefficiencies, and legislative gaps make it difficult for Ethiopia to compete in the global honey market. The country needs a strategy which combines short-term interventions with long-term structural changes to transition from volume-based commodity exports to high-value, environmentally friendly industry leadership. This paper collects important ideas, examines their consequences, and provides strategic recommendations for further research.

Short-Term Industry Stabilization: Addressing Immediate Barriers (1-3 Years)

The honey export industry of Ethiopia requires addressing significant inefficiencies in processing technology, regulatory compliance, market positioning, and capital access during the short-term period of one to three years. The constraints in question significantly hinder Ethiopia's potential by restricting its ability to secure leading positions in the market, thereby obstructing the achievement of economies of scale and impeding its capacity to meet international quality standards.

Processing and Refining Deficiencies as a Market Bottleneck

The lack of advanced filtration and refining facilities creates problems with product uniformity and tracking, resulting in high rejection rates in the EU and North American markets. Refining products consistently allows Ethiopian producers to follow guidelines and build credibility. The Ethiopian government should establish cooperative processing facilities following Argentina's model to achieve international compliance.

Market Access and Price Competitiveness Constraints

Ethiopian honey does not have the cost advantages of Chinese exporters and the premium branding of New Zealand's Manuka honey. The high domestic consumption limits the available exportable surpluses, meaning Ethiopia cannot benefit from the economies of scale. In addition, a geographical indication (GI) strategy could improve market positioning, increase brand distinctiveness and secure premium pricing.

Regulatory Weaknesses and the Role of Illegal Trade

The lack of proper regulatory enforcement allows illegal trading, price manipulation, and adulteration to occur, which damages the global market confidence in Ethiopian honey exports. The fair-trade value of the product is limited without proper tracking methods. Implementing blockchain-based traceability similar to that in Argentina and the EU would eliminate fraud, increase transparency, and secure access to stringent markets.

Financial Constraints and Credit Access Limitations

The lack of access to modern hive technologies, processing facilities, and certification programs creates significant challenges for smallholder beekeepers because of their limited microfinance options and high financing rates. A financing framework led by cooperatives which connects exporters with financial institutions and government agencies would drive small-scale producers toward better yields and export manufacturing.

Long-Term Strategic Transformation for Industry Overhaul and Market Leadership (3-10 Years)

The honey export model of Ethiopia should be based on values and environmentally sustainable rather than on short-term solutions. This calls for industrial efficiency, sustainability certification, product differentiation, and financial resources to improve regulatory frameworks.

Transitioning from Commodity Exports to Value-Added Products

The economy of Ethiopia depends on the export of raw honey and therefore requires careful management of profit margins and price fluctuations. Ethiopia should develop medical honey, royal jelly and organic certified honey as high-value derivatives to improve its global competitiveness. The success of New Zealand’s Manuka honey requires strategic investments in research and product innovation to enhance health-focused marketing and target premium consumer segments.

Sustainability as a Competitive Advantage

The growing influence of financial constraints on sustainability discussions requires honey producers to follow ethical and ecological practices for long-term market integration. The honey industry uses certifications, including Fairtrade, EU Organic and USDA Organic, to establish market competitiveness in high-value markets. The sector will gain strength through national fair-trade standards and sustainability branding based on Ethiopia's diverse biodiversity.

Industrial Scaling and Market Expansion

Smallholder beekeepers control most of the production, which produces low yields. The country differs from Argentina because it does not have government-backed industrialization or microloans to scale production. The integration of processing facilities with hive technologies through cooperative management structures provides a strategic approach to boost production efficiency and global competitiveness.

Strengthening Regulatory Frameworks for Global Market Integration

Ethiopia's market efficiency is hampered by opaque export licensing, bureaucratic red tape, and clandestine trade networks. The company will remain uncompetitive globally if it does not modernize its regulations. The company must adopt transparent governance through digitized licensing, streamlined compliance, and robust anti-smuggling measures to achieve lasting stability and investor confidence.

Policy and Industry Implications

Mass honey production in Ethiopia should focus on quality, branding, and sustainability to compete with China in terms of cost if it is to compete. Combining New Zealand's branding expertise with Argentina's industrial efficiency offers a strong opportunity to move Ethiopia from its current position as a small exporter to a global leader. This research identifies three key imperatives for policy and industry:

1. The immediate stabilization requires urgent financial accessibility investments, regulatory enforcement and advanced processing technology.
2. To achieve premium pricing in high-value markets, it is important to increase customer confidence and market penetration. This strategy cannot be implemented without robust branding, traceability and sustainability certifications.
3. The industry's continued success depends on moving away from bulk commodity exports to value-added honey products, which will reinforce Ethiopia's reputation for quality and sustainability.

Alignment with SDGs

The research supports the United Nations Sustainable Development Goals by examining key legal, financial, and environmental challenges in Ethiopia's honey sector. The proposed STB-ECM integrates these considerations into a comprehensive strategy for efficient honey production and export. The study outlines strategic approaches to alleviate poverty (SDG 1), foster economic growth (SDG 8), and enhance climate resilience (SDG 13) by aligning projects with the SDGs. Table 9 summarizes the research contributions and solutions to bolster sustainable development in Ethiopia's apicultural value chain.

Table 23 Study Alignment with SDGs (United Nations, n.d.)

SDG	Key Focus	How Research Exemplifies the Goal
SDG 1: *No Poverty*	End poverty in all its forms everywhere	Smallholder farmers in Ethiopia can generate sustainable income by beekeeping, which helps them diversify their income streams. The paper demonstrates the requirement for better loan access to purchase modern hives and enhance processing capabilities and market participation for financial inclusion in local communities.
SDG 8: *Decent Work and Economic Growth*	Promote sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for all	Exporting honey creates economic growth through manufacturing, processing, and distribution, providing employment opportunities. Establishing training programs for modern beekeeping and sustainable harvesting and quality assurance and skill enhancement initiatives will create sustainable employment opportunities.
SDG 9: *Industry, Innovation, and Infrastructure*	Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation.	The industry requires immediate implementation of contemporary processing systems and traceability frameworks, which include refining facilities and blockchain technology to improve product quality and global trust. The honey industry needs substantial funding for advanced technologies, including modern beekeeping equipment, hive innovations, and digital solutions to enhance production efficiency and sustainability.
SDG 12: *Responsible Consumption and Production*	Ensure sustainable consumption and production patterns.	Quality assurance enhancement and adulteration mitigation protect consumers from harm while preserving trust in the honey industry. The method supports organic, sustainable production using pesticide-free practices, decreasing environmental impact and guaranteeing ethical sourcing.
SDG 13: *Climate Action*	Take urgent action to combat climate change and its impacts.	Supporters advocate for adaptive beekeeping practices, including climate-resilient hive management and habitat conservation, to protect vital pollinators. The initiative demands climate-smart methods, agroforestry, and low-carbon refining techniques, including solar-powered extraction, to minimize the carbon emissions of the apicultural sector.
SDG 15: *Life on Land*	Protect, restore, and promote sustainable use of terrestrial ecosystems.	The paper emphasizes the necessity of protecting pollinators and explains how bees contribute to biodiversity conservation. The paper supports habitat protection and ecosystem restoration, together with decreased agrochemical usage, sustainable beekeeping practices, and expanded pollinator-friendly landscapes to maintain strong bee populations and ecosystem health.
SDG 17: *Partnerships for the Goals*	Strengthen the means of implementation and revitalize the global partnership for sustainable development.	The urgent need requires government agencies to work with cooperatives, exporters, certification bodies, and research institutions through multi-stakeholder engagement. The strategy builds capacity while spreading best practices and advocating for financial frameworks and uniform regulations to enable global market access.

RECOMMENDATIONS FOR STRATEGIC INTERVENTIONS

The honey industry must implement sustainable solutions for Ethiopia to establish enduring stability while strengthening its international position and minimizing operational inefficiencies. The Triple Bottom Line demands a complete transformation because minor tweaks will not achieve financial viability, social equity, and environmental sustainability. The strategic recommendations for Ethiopia's honey sector derive from benchmark research that compares the industry to major exporters such as Argentina, China and New Zealand.

Table 10: Strategic Recommendations, Policy, and Market Interventions Based on Comparative Analysis

Key Issue	Current Ethiopian Situation	Successful Model (Benchmark Country)	Recommended Action
Processing Technology	Traditional methods have poor refining capacity.	Argentina's modern refining and quality control	Invest in centralized processing hubs.
Market Positioning	No premium branding. High Local Demand	New Zealand's Manuka honey strategy: High-Value Niche Markets (e.g., Organic, Fair-Trade). Global Market Focus	Develop Ethiopian honey's unique market identity.
Export Regulations	Weak enforcement, no blockchain traceability	China's robust compliance systems. Robust Regulation	Implement blockchain-based honey traceability.
Fair-Trade Certification	Limited adoption. Limited Certification	Argentina and New Zealand's fair-trade labelling	Develop a government-backed certification initiative
Production Scaling	High fragmentation, smallholder-dominated. Small-Scale Production	Argentina's industrial/large-scale processing operations. China's Cost Leadership Model	Introduce cooperative-led commercial honey farms

Ethiopia's honey value chain initiatives depend on social, environmental and financial sustainability as shown in Table 11. Combining blockchain traceability and export certification with cooperative marketing strategies promotes market development, and microfinance enables scalability and financial inclusion.

Environmental preservation requires more than zero-waste processing and solar-powered refining because it needs agroforestry, pesticide-free zones, and effective hive management to address climate change. Social sustainability requires precise standards, anti-fraud regulations, international certification alignment, and coordinated pricing strategies. The industrial resilience will be further strengthened in the long term by enhancing capacity through skill development, targeted training, climate adaptation research and gender-inclusive initiatives.

Table 11: Sustainability-based Strategies for Ethiopia's Honey Value Chain

Category	Sub-category	Recommended Tactics
Economic Sustainability: Market Development and Financial Inclusion	**Enhancing Market Transparency and Competitiveness**	Blockchain-based traceability will help restore consumer confidence, guarantee product purity, and enhance Ethiopia's position in premium markets.
		Export certification should incorporate global Fairtrade and organic standards, enabling access to lucrative markets like the United States and the European Union.
		Cooperative-led marketing enables smallholder beekeepers to boost financial returns, secure stable pricing, and reduce intermediary exploitation.
	Financial Inclusion and Investment Mechanisms	Government-backed microfinance initiatives must be meticulously designed to support smallholder beekeepers, facilitating investments in cutting-edge hive technologies and ecologically sound processing techniques.
		The sustainability and scalability of beekeeping can be enhanced by providing direct financial incentives for eco-friendly honey production and value-added

		diversification (e.g., medicinal honey, beeswax products) and export-oriented certification.
Environmental Sustainability: Sustainable Production and Processing	**Sustainable Beekeeping Practices**	Implementing pesticide-free beekeeping zones will substantially protect pollinators while maintaining a balance between honey production.
		Expanding apiculture models that combine agroforestry practices should be pursued because they create multiple nectar sources, supporting biodiversity and climate change resilience.
		The research should focus on developing hive management strategies that are climate change resilient, especially for managing the impacts of inconsistent weather on nectar availability.
	Processing Infrastructure and Zero-Waste Production	Combining solar power with energy-efficient refining plants creates better honey consistency while reducing the industry's environmental impact.
		The practice of honey production that follows zero waste principles becomes possible through combining beeswax with pollen remnants, creating both waste reduction and new revenue streams.
		Implementing cold storage and processing facilities enhances post-harvest infrastructure, optimizes supply chains, reduces waste, and elevates export quality.
Social Sustainability: Regulatory Strengthening and Capacity Building	**Strengthening Governance and Market Regulation**	Protecting Ethiopia's reputation in the global marketplace requires strong anti-adulteration measures, strict quality control enforcement, and penalty implementation to combat honey fraud.
		The first step involves following international standards by adopting frameworks such as Fairtrade and USDA Organic to gain access to profitable export markets.
		Smallholder producers will gain stronger negotiating power while price stability improves through cooperative-led honey aggregation initiatives.
	Capacity Building and Knowledge Transfer	Establishing specific training courses is crucial for assisting smallholder beekeepers in meeting certification criteria, improving hive management practices and enabling them to enter export markets.
		Universities should extend their research efforts regarding forage optimization, climatic adaptation, and honey yield improvement. The agricultural sector requires such expansion to produce data-driven best practices.
		Financial incentives will support initiatives that promote gender inclusiveness and youth engagement, which will drive sector diversification and enhance long-term resilience.

Table 12 presents policy measures to enhance the honey industry in Ethiopia through processing, financial support, market expansion, sustainability, and digital transformation:

Table 12 Policy Interventions and Specific and Measurable Strategic Actions

Policy Area	Strategic Objective	Intervention	Key Metrics
Processing and Quality Enhancement	Ensure 100% compliance with EU and US honey quality standards.	Establish government-backed refining centers	Number of operational refining hubs
		Mandate blockchain-based traceability for exports	100% compliance
Financial Support for Smallholder Beekeepers	Increase credit accessibility	Launch microfinance-backed honey cooperative programs	Specific amounts are disbursed annually
		Provide financial incentives for organic certification.	Annual Increase in percentage of certified exports
Export Market Expansion and Branding	Position Ethiopia as a premium organic honey exporter	Develop a national branding strategy for premium honey varieties	Number of secured international trademarks and GI certifications
		Negotiate trade agreements with high-value markets (EU, Japan, USA)	Annual increase percentage in export market diversification
Sustainability-Driven Beekeeping Policies	Ensure Ethiopia's honey exports meet sustainability and fair-trade standards	Introduce mandatory sustainability certification for large-scale exporters	100% certification compliance
		Expand agroforestry and pollinator conservation incentives.	The annual increase in the percentage of bee-friendly land use
Digital Transformation and Supply Chain Modernization	Modernize Ethiopia's honey supply chain using digital platforms	Implement blockchain-based traceability systems	100% digital tracking of exports
		Develop AI-driven market intelligence for honey exporters	Number of honey traders and cooperatives using digital insights

Table 13 presents a comprehensive framework for Ethiopia's honey industry, detailing short-, medium-, and long-term strategies to foster sustainable growth:

Table 12: Strategic Roadmap for Ethiopia's Honey Industry

Short-Term Fixes (1-3 Years)	**Medium-Term Reforms (3-5 Years)**	**Long-Term Transformation (5+ Years)**
Improve refining technology	Introduce national honey branding (e.g., Ethiopian White Honey)	Scale value-added honey exports (medicinal, organic)
Strengthen regulatory enforcement and traceability.	Implement cooperative-led financing for smallholders	Establish Ethiopia as a global leader in ethical honey
Expand certification programs (organic, fair-trade)	Develop export-focused sustainability policies	The transition from volume-driven to value-driven exports

Ethiopia will become a major player in the global honey market, capitalizing on its distinct varieties and ancient beekeeping culture. The country can gain a competitive advantage in the world market by adhering to international standards and embracing sustainability reforms.

RESEARCH LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

This study systematically assesses the key factors influencing Ethiopia's sustainable honey production and export. However, it is important to recognize the inherent natural constraints to improve the interpretation of the findings and direct future research.

Research Limitations

1. **Geographic Scope Constraints –** Addis Ababa provides important market trend information as a significant hub for the honey trade and exports. However, Ethiopia's apicultural landscape is not fully represented in forest-dependent and smallholder regions. Future research should extend into rural and ecologically varied areas to better understand sustainability challenges and local constraints.

2. **Data Availability and Reliability Issues –** The data reliability is limited because there is no established official framework and systematic market information collection system in the honey industry. The report is based on professional expertise and business reporting methodologies that minimize potential biases. Future research should include blockchain-based traceability systems with comprehensive rural evaluations, actively engaging stakeholders to improve data transparency and reliability.

3. **Methodological Scope and Alternative Approaches –** The AHP and ISM systematic approach demonstrates element relationships and environmental priorities. Fuzzy AHP and Decision-Making Trial and Evaluation Laboratory (DEMATEL) provide alternative methods that will reveal more complex relationships and improve the accuracy and sensitivity of future factor weight analyses.

4. **Temporal and Market Dynamics Limitations –** The data collection has a time-bound nature, which means that the results are affected by the global market trends, changes in legislation and climate-related changes in pollination. The honey industry in Ethiopia needs longitudinal research with multi-year data sets and trend analyses to capture these nuances.

5. **Sustainability Measurement Constraints –** The research covers social, economic, and environmental sustainability. Future studies may also consider how changes in consumer attitudes and fluctuations in global demand influence their results. The incorporation of demand-side analytics with trade policy evaluations would provide empirical evidence to support our findings and improve our understanding of Ethiopia's competitive position in the global honey market.

6. **Stakeholder Representation and Inclusivity –** The research includes insights from producers, exporters, and legislators, but smallholder beekeepers, cooperatives, and consumer advocacy groups remain underrepresented. Future studies should use participatory approaches, such as Delphi studies or structured focus groups, to incorporate grassroots sustainability perspectives and address microeconomic market access challenges.

Future Research Directions

The research introduces a strong model for identifying constraints in the honey export industry of Ethiopia, but future studies will need to establish its usefulness and applicability.

1. Future studies need to use advanced machine learning and AI-driven predictive analytics for trade forecasting and sustainability evaluations. AI-driven frameworks for optimizing Ethiopia's honey value chain need integrated demand forecasting, supply chain resilience assessments, and strategic pricing within dynamic optimization models.

2. Through longitudinal policy impact evaluations researchers can track how blockchain traceability and microfinance acceptance influence long-term outcomes which provides direct support for strategic policymaking.

3. Vertical beekeeping combined with controlled-pollination strategies demonstrates economic sustainability potential for large-scale urban honey production through urban apiculture frameworks according to research findings. This perspective requires more research and empirical studies.

4. Research expansion into the wider agricultural sector including agroforestry and pollination services provides a pathway to achieve comprehensive sustainability through interdisciplinary integration.

5. A systematic analysis of the social, environmental and financial effects of fair-trade certification systems, carbon-neutral logistics and agroecological beekeeping on the Ethiopian honey industry.

6. More research on financial and policy mechanisms for export competitiveness are analyzed to enhance the country's position through the use of financial instruments that are sustainability oriented and export credit mechanisms and regulatory alignment strategies.

7. Research into blockchain technology shows its potential to improve honey traceability systems which increases supply chain transparency and quality assurance while building consumer trust in high-end international markets.

8. Cross-national comparative analyses with leading honey-exporting nations enable researchers to identify exemplary governance frameworks trade regulations and market differentiation strategies.

4. Conclusion

This paper examines the institutional barriers that affect competitiveness and sustainable value creation in the honey value chain of Ethiopia and contributes to the debate on the country's export potential. It systematically examines three main causes of stagnation: sustainability challenges (environmental, social, and economic), trade barriers (market access, price competitiveness, export regulations, and quality control), and economic limitations (credit access, technology gaps, and value chain inefficiencies). The study uses the AHP-ISM combined methodology to identify the most important factors that affect Ethiopia's standing in the global premium honey market, which include poor processing facilities, weak regulatory enforcement, limited capital, volatile prices, illicit trade practices, and poor governance. It also introduces a Sustainability-Trade Barrier-Economic Constraint Model (STB-ECM) to elucidate the interdependencies among sustainability challenges, trade barriers, and economic constraints hindering Ethiopia's honey export sector integrating three main dimensions: Sustainability Factors, Trade Barriers and Economic Constraints. The research demonstrates that the Ethiopian honey industry can transform through market positioning strategy combined with financial inclusion and sustainability commitment rather than relying on temporary regulations. The industry will achieve international quality standards through improved processing methods and post-harvest management and technological integration while cooperative trade models and strict phytosanitary measures and expanded microfinance opportunities will boost sector resilience and global competitiveness. The research also demonstrates how sustainability offers strategic value as a competitive advantage. The adoption of fair-trade certified systems together with carbon-neutral supply chains and agroecological beekeeping practices will allow Ethiopian honey to fulfill global sustainability requirements and establish itself as a premium ethically produced product in markets that value environmental responsibility. The industry needs these fundamental changes to prevent losing its market position to competitors who have better global market access and environmental sustainability.

Acknowledgements

We thank Dr. Rex Holiday for his invaluable support and guidance throughout this study and Dr. Ehab Abdel-Rahim Ali for his insightful scientific review. We also appreciate the technical support of the Ethiopian Agricultural Transformation Institute (ATI). We are incredibly grateful to the participants whose time and perspectives were crucial to this research. Finally, we acknowledge the Writing Center at Windsor University's invaluable assistance in refining and enhancing this manuscript.

References

Abbas, H., Mehdi, M., Azad, I., & Frederico, G. (2022). Modelling the abstract knots in supply chains using interpretive structural modelling (ISM) approaches: A review-based comprehensive toolkit. *Benchmarking: An International Journal, 29*(10), 3251-3274. doi:https://doi.org/10.1108/BIJ-08-2021-0459

Addisu, W. (2011). *The role of multipurpose farmer cooperatives in the supply chain of wheat in Gedeb-Hasasa Woreda, Oromia Regional State, Ethiopia (Doctoral dissertation).* The Institute of Development Studies and Partner Organisations. Retrieved from https://opendocs.ids.ac.uk/articles/thesis/The_Role_Of_Multipurpose_Farmer_Cooperatives_In_The_Supply_Chain_Of_Wheat_In_Gedeb-Hasasa_Woreda_Oromia_Regional_State_Ethiopia/26452954?file=48102451

ApisProtect & Inmarsat. (2019). *Inmarsat partners with ApisProtect to save bees and increase global crop production.* Inmarsat. Retrieved from https://www.inmarsat.com/en/news/latest-news/enterprise/2019/inmarsat-partners-with-apisprotect-to-save-bees-and-increase-global-crop-production.html

Beck-O'Brien, M., & Bringezu, S. (2021). Biodiversity monitoring in long-distance food supply chains: Tools, gaps and needs to meet business requirements and sustainability goals. *Sustainability, 3*(15). Retrieved from https://www.mdpi.com/2071-1050/13/15/8536

Bose, D., & Padmavati, M. (2024). Honey authentication: A review of the issues and challenges associated with honey adulteration. *Food Bioscience, 61*. doi:https://doi.org/10.1016/j.fbio.2024.105004

Dekebo, A., Bisrat, D., & Jung, C. (2019). Opportunities and constraints of beekeeping practices in Ethiopia. *Journal of Apiculture, 34*(2), 169-180. doi:https://doi.org/10.17519/apiculture.2019.06.34.2.169

Fairtrade International. (2019). *2019-2020 Annual Report.* Fairtrade International. Retrieved from https://www.fairtrade.net/en/get-involved/library/2019-2020-annual-report.html

FAO. (2022). *Ethiopia honey export statistics.* Food and Agriculture Organization. Retrieved from https://openknowledge.fao.org/server/api/core/bitstreams/cd12276d-6933-4971-8fb9-b577c8bfad5c/content/

Feleke, E. (2025). Honey value chain analysis in Ethiopia - an overview. *Journal of Livestock Science, 16*, 15-27. doi:doi. 10.33259/JLivestSci.2024.15-27

Gebremedhin, D. (2020). *Characterization Of Beekeeping Practices And Honey Quality In Chena District, Kaffa Zone, Southern Nation, Nationalities And Peoples Region, Ethiopia.* College of Agriculture and Environmental Sciences Graduate Program in Animal Production. Retrieved from https://www.academia.edu/45600774/College_of_Agriculture_and_Environmental_Sciences_Graduate_Program_in_Animal_Production_CHARACTERIZATION_OF_BEEKEEPING_PRACTICES_AND_HONEY_QUALITY_IN_CHENA_DISTRICT_KAFFA_ZONE_SOUTHERN_NATION_NATIONALITIES_AND_PEOPLES_REG

Gill, C. (2023). *Organic beekeeping rivals conventional methods for bee health, productivity.* Penn State University. Retrieved from https://www.psu.edu/news/agricultural-sciences/story/organic-beekeeping-rivals-conventional-methods-bee-health-productivity

Global Market Access Programme (GMAP). (2023). *Strengthening the quality compliance capacity of the honey value chain for greater market access.* United Nations Industrial Development Organization (UNIDO). Retrieved from https://hub.unido.org/sites/default/files/publications/ONLINE_EHTHIOPIA_GMAP_PUBLICATION_0.pdf

Goshme, D., & Ayele, T. (2020). Constraints of honey production and marketing in Ethiopia: A review. *Agricultural Reviews, 41*(4), 393-397. doi:https://doi.org/10.18805/ag.R-172

Grand View Research. (2025). *Honey market size, share & trends analysis report.* Grand View Research. Retrieved from https://www.grandviewresearch.com/industry-analysis/honey-market

Gratzer, K., Wakjira, K., Fiedler, S., & Brodschneider, R. (2021). Challenges and perspectives for beekeeping in Ethiopia: A review. *Agronomy for Sustainable Development, 41*(46). doi:https://doi.org/10.1007/s13593-021-00702-2

Haddad, F., Ariza, C., & Malmer, A. (2021). Building climate-resilient dryland forests and agrosilvopastoral production systems: An approach for context-dependent economic, social and environmentally sustainable transformations. *Food & Agriculture Organization of the United Nations*. doi:https://doi.org/10.4060/cb3803en

Hendricks, L. (2021). An analysis of eco-labelled honey practices employed in the South African beekeeping industry: implications for agricultural sustainability. Stellenbosch University. Retrieved from https://scholar.sun.ac.za/handle/10019.1/124014

Herreros, S., & Ali, M. (2023). Sustainable practices in honey production. *International Journal of Agriculture and Nutrition, 5*(2), 54-56. doi:https://doi.org/10.33545/26646064.2023.v5.i2a.141

Hunde, T. (2025). The potential and transformation of beekeeping for natural resource conservation and poverty reduction in Ethiopia: A review. *International Journal of Environmental Protection and Policy, 13*(1), 1-13. Retrieved from https://sciencepublishinggroup.com/article/10.11648/j.ijepp.20251301.11

Institute for Strategy and Competitiveness. (n.d.). *The value chain.* Harvard Business School. Retrieved from https://www.isc.hbs.edu/strategy/business-strategy/Pages/the-value-chain.aspx

Isabirye, P. (2023). What Is Peculiar in the Sustainability Practices of Indigenous Female Business Owners in Uganda? In O. Adeola (Ed.), *Casebook of Indigenous Business Practices in Africa* (pp. 71-103). Emerald Publishing Limited. Retrieved from https://www.emerald.com/insight/content/doi/10.1108/978-1-80455-762-420231009/full/html

Kassaye, A., Shao, G., Wang, X., & Belete, M. (2022). Evaluating the practices of climate-smart agriculture sustainability in Ethiopia using geocybernetic assessment matrix. *Environment, Development and Sustainability, 24*(1), 724-764. doi:https://doi.org/10.1007/s10668-021-01466-1

Kumar, A., & Pant, S. (2023). Analytical hierarchy process for sustainable agriculture: An overview. *MethodsX, 10*. doi:https://doi.org/10.1016/j.mex.2022.10

Linkov, I., Carluccio, S., Pritchard, O., Ní Bhreasail,, A., Galaitsi, S., Sarkis, J., & Keisler, J. (2020). The case for value chain resilience. *Management Research Review, 43*(12). Retrieved from https://www.emerald.com/insight/content/doi/10.1108/mrr-08-2019-0353/full/html

Liverpool-Tasie,, L., Wineman, A., Young, S., Tambo, J., Vargas, C., Reardon, T., . . . Celestin, A. (2020). A scoping review of market links between value chain actors and small-scale producers in developing regions. *Nature Sustainability, 3*(10), 799-808. doi:https://doi.org/10.1038/s41893-020-00621-2

Modern Farmer. (2022). *10 Drought-Tolerant Crops to Plant Amid Water Scarcity.* Modern Farmer. Retrieved from https://modernfarmer.com/2022/06/drought-tolerant-crops/

Nico, G., & Christiaensen, L. (2023). *Jobs, Food and Greening.* World Bank. Retrieved from https://openknowledge.worldbank.org/server/api/core/bitstreams/3e51192f-9944-4663-ad54-05880fd5db42/content

Prodanovič, R., Brkić, I., Soleša, K., Ljubojević Pelić, D., Pelić, M., Bursić, V., & Vapa Tankosić, J. (2024). Beekeeping as a Tool for Sustainable Rural Development. *Journal of Agronomy, Technology and Engineering Management*, 1054-1066. Retrieved from https://www.fimek.edu.rs/downloads/casopisi/jatem/issue/v7_2/1_%281%29_J_Agron_Technol_Eng_Manag_2024_7%282%29_1054-1066._httpsdoi.org10.55817IXVM2800.pdf

Stratton, S. (2023). Population sampling: Probability and non-probability techniques. *Prehospital and Disaster Medicine, 38*(2), 147-148. doi:doi:10.1017/S1049023X23000304

Tadesse, A. (2019). Opportunities and challenges of honey and bees wax production in Ethiopia: A systematic review. *Advances in Life Science and Technology, 72*(36). doi:DOI: 10.7176/ALST/72-04

Tafesse, A., Mena, B., Belay, A., Aynekulu, E., Recha, J., Osano, P., . . . Solomon, D. (2021). Cassava Production Efficiency in Southern Ethiopia: The Parametric Model Analysis. *Frontiers in Sustainable Food Systems, 5*. doi:https://doi.org/10.3389/fsufs.2021.758951

Tavana, M., Soltanifar, M., & Santos-Arteaga, F. (2023). Analytical hierarchy process: Revolution and evolution. *Annals of Operations Research, 329*(2), 879-907. doi:https://doi.org/10.1007/s10479-021-04432-2

Tegegne, A., Feye, G., & Gebre-Egziabher, T. (2020). Study of Selected Livestock Innovations in Ethiopia. Consultative Group on International Agricultural Research (CGIAR). Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3653067

The IGAD Biodiversity Management Programme. (2016). *IGAD BMP Technical Brief No 1 : Honey Value Chain Development.* World Agroforestry Centre. Retrieved from https://www.cifor-icraf.org/publications/downloads/Publications/PDFS/BR15621.pdf

UNCTAD. (2020). *Adoption of new investment liberalisation measures.* Investment Policy Monitor. Retrieved from https://investmentpolicy.unctad.org/investment-policy-monitor/measures/3559/adoption-of-new-investment-liberalisation-measures-

UNIDO. (2024). *Industrial Development Report 2024.* United Nations Industrial Development Organization. Retrieved from https://www.unido.org/idr/idr2024

Urugo, M., Tola, Y., Kebede, B., & Ogah, O. (2024). 'Insight into the effects of environmental variables on the physicochemical characteristics and biochemical composition of green Arabica coffee. *Beverage Plant Research, 4, e021*. doi:https://doi.org/10.48130/bpr-0024-0021

World Food and Agriculture. (2022). *Statistical yearbook: World food and agriculture 2022.* Food and Agriculture Organization of the United Nations. Retrieved from https://openknowledge.fao.org/bitstreams/cd12276d-6933-4971-8fb9-b577c8bfad5c/download