Project title: Ethiopian Honey Market Access and

Trade-Capacity Building Support

Objective: Desk Review

on

Ethiopian Honey Value Chain Analysis

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Abbreviations

AFRIMETS	Intra-Africa Metrology System
ANAB	ANSI National Accreditation Board
ANSI	American National Standards Institution
ATA	Advance Technology Attachment
BIPM	International Bureau of Weights and Measure
CMC	Calibration Measurement Capability
CODEX	Codex Alimentarius
CRM	Certified Reference Materials
DG	Director General
DAKKS	National Accreditation Body for the Federal Republic of Germany
ECAE	Ethiopian Conformity Assessment Enterprise
EFDA	Ethiopian Food and Drug Authority
ENAO	Ethiopian National Accreditation Office
ESA	Ethiopian Standard Agency
GMP	Good Manufacturing Practice
GTP	Growth and Transformation Program
IAF	International Accreditation Forum
IEC	International Electro-technical Commission
ILAC	International Laboratory Accreditation Cooperation
ISO	International Organization for Standardization
MLA	Multilateral Recognition Arrangement
MRA	Mutual Recognition Arrangement
NMIE	National Metrology Institution of Ethiopia
NQI	National Quality Infrastructure
NQIDP	National Quality Infrastructure Development Project

OIML	International Organization of Legal Metrology
PT	Proficiency Tests
QI	Quality Infrastructure
SGS	Société Générale de Surveillance
SME	Small and medium sized enterprises
SPS	Sanitary and phytosanitary measures
TBT	Technical Barriers to Trade
TC	Technical Committee
WTO	World Trade Organization

Content

Tables

Figures

Charts

1 Executive summary

Honey is produced by bees which is an edible nutritional health food that facilitates for better physical performance of our body and higher mental efficiency that can been taken by all levels of human being from child to old, from patient to health persons and also used as additive for sweetener and flavor in food and drinking items; it is also used in the detergent and cosmetic industry and because of these the demand of honey is growing from time to time globally. Therefore, to support Ethiopia to be one of the best honey producers in the world, desk review of inception has been done by assessing the potential production areas, production, collection, transporting, storing, processing, packaging, labeling, marketing, quality requirements and quality service providing units, opportunity, challenges and recommendations.

Beekeeping is one of the income generating economic sectors for millions of Ethiopian small hold farmers engaged in any of the four types of honey production practices: traditional forest honey production, traditional backyard beekeeping, traditional beekeeping and improved beekeeping. The most honey and beeswax producer regions are Oromia, South Nation and Nationality and people, Amhara, Tigray and Benishangul Gumuz; the remaining regions are producing small amount. The honey's color, texture, aroma and flavor vary from region to region that depends on the type of bee forage.

The local honey market need is higher compared to the export market which is because of the local honey wine " tej" demand despite no technical regulation quality control parameters that either tej or honey for tej that shall comply and to be verified by testing, inspection and certification; whereas the export honey requires to comply the international and customer quality requirements and attested by internationally recognized (Accreditation body signatory to ILAC-MRA) conformity assessment bodies. The government of Ethiopia is striving the honey market to be led by free market competition that requires computing by quality based quantity supply, on time delivery and cost. The role of the government is limited on capacity development, research work to solve existing and future problems and regulatory red tape by establishing Oromia Honey research center situated in Holeta, Mekelle Soil research center department of honey research laboratory situated in Mekelle, Tigray and Ethiopian Meat and Dairy Development Institution situated in Busheftu, Oromia. All Ethiopian universities are open when their students have an interest to engaging on research to conduct their graduation thesis / paper.

There is no applicable technical regulation that applies for honey in any part of the value chain expected to comply the voluntary standard developed by Ethiopian Standard Agency which is Honey Specification (ES 1202:2015) and Beeswax Specification (ES1203:2015). Many of the working measuring equipments are traceable to the international measurement by National Metrology Institution of Ethiopia. However, the calibration providers are concentrated at the capital city, Addis Ababa except Bureau of Science and Technology Tigray which provides non accredited mass calibration service. The Ethiopian National Accreditation Office is ILAC- MRA signatory for testing (ISO/IEC 17025:2017), medical testing (ISO 15189:2012) and inspection (ISO/IEC 17020:2012), but it needs to work for the international recognized accreditation service to conformity assessment bodies engaged in calibration, system certification, product certification and certification for person. There are governmental and private conformity service providers situated in either Addis Ababa (Ethiopian Conformity Assessment Enterprise, JIJI Lab and Bless Lab) or around Addis Ababa (Oromia Agriculture Research Institution, Bee Research Center and Ethiopian Meat and Dairy Development Institution situated at Holeta and Bishoftu respectively which provides limited conformity assessment services). At Mekelle Soil Research Center there is Honey Laboratory Department that provides very limited conformity assessment service.

The quality infrastructure units are not linked across the honey value chain to support productivity and quality production and to avoid quality failure that comes from substandard collection, transportation, storing, processing, packaging and labeling. Even if those engaged in the value chain are interested to check the quality of their product, they can't get the conformity assessment service at a closer distance, they have to send the sample to Addis Ababa or abroad. The schemes, Good Manufacturing practice of honey and /or organic certification are not commonly known and not communicated to beekeeper.

There are three ministerial sectors that have been engaged in the regulation: Ministry of Agriculture and Livestock, Ministry of Trade and Industry and under Ministry of Health, Food and Drug Authority. However, their regulation practice is not active and no platform that enables to regulate the compliance of the stipulated requirements expected by importing countries or customers across value chain which is from production to national and international markets. If there is no quality verifier across the value chain, it will be difficult to be sure the sustainability and continuity of

quality honey delivered to consumers. Had the quality requirements of importing countries been complied and provide the required volume on time, there is potential interest to import by German, Norway, Sudan, United States, Yemen, Japan, Qatar, United Kingdom, Saudi Arabia, and other countries.

2 Overview of the honey sector in Ethiopia

Honey is defined in the Codex Alimentarius (2001) as, the natural sweet substance produced by honey-bees from the nectar of plants or from secretions of living parts of plants, or excretions of plant-sucking insects on the living parts of plants, which the bees collect, transform by combining with specific substances of their own, deposit, dehydrate, store and leave in honey-combs to ripen and mature.

One of the important properties of honey is its stability for a very long period of time. This is because of an enzyme found in the stomachs of bees. When the enzyme glucose oxidase mixes with the nectar, it creates the by-products gluconic acid and hydrogen peroxide, which contribute to honey's acidity and antibacterial properties. However, honey should be free from visible mould and as far as practicable, be free from inorganic or organic matters foreign to its composition, such as, insects, insect debris, brood or grains of sand, when the honey appears in retail trade or is used in any product for human consumption. Honey shall not contain toxic substances arising from microorganisms in an amount which may constitute a hazard to health.

Honey facilitates better physical performance and resistance to fatigue, particularly for repeated effort; it also promotes higher mental efficiency [30].-It is therefore used by both the healthy and the sick for any kind of weakness, particularly in the case of digestive or assimilative problems. Improved growth of non-breast fed new born infants, improved calcium fixation in bones and curing anaemia and anorexia may all be attributed to some nutritional benefit or stimulation from eating honey [29].

Honey is a nutritious, healthy and natural food produced by bees. Its benefits go beyond its use as a sweetener as it contains several minerals, enzymes, vitamins and proteins that confer unique nutritious and organoleptic properties. Honey can be monofloral, if one specific plant nectar and pollen content prevails in pre-defined percentages, or polyfloral, if it contains an unspecified mix of different nectars and pollens. Hence, honey is commonly classified according to its floral source. Honeys can be made either from one flower source or blended after collection. Mono-floral honeys have distinctive flavours and colours due to differences in nectar source, some of which are clover, orange blossom, lavender, and honeysuckle.

Honey contains both organic and amino acids. The aliphatic acids in honey contribute greatly to the flavor. The typical pH of honey is 3.9. The melting point of crystallized honey is between 40°C and 50°C. The moisture content ranges from 13% to 20%. When heated, honey caramelizes, becoming darker in color. Amino acids present in honey form melanoidin compounds during the Maillard browning reaction.

Honey is composed primarily around of 38% fructose and 31% glucose. In addition, maltose, sucrose, and other complex carbohydrates are present. Honey possesses a distinctive flavor and attractive chemical properties. Other components in honey include vitamins, minerals, acids, pollen, and enzymes, which make honey unique constituents.

Due to environmental, geographical and climatic conditions, honey may vary in pollen content and relative humidity. Honey is produced on all six out of seven continents and its consumption varies from country to country also due to cultural reasons and dietary habits.

2.1 Production and processing techniques, packaging and logistics:

Beekeeping is perhaps one of the most important income-generating activities for millions of Ethiopian smallholder farmers produced as a cash crop, selling almost all (90--95%) of what they have produced [6]. Ethiopia has two honey harvesting seasons; the major harvesting season is the time that collects after the flowery month (September) has been ended which is from October to November; and the second harvesting time is from April to June. There is an additional brief harvesting time that depends on the availability of flowers that grow from unseasonal rainfall.

According to Holeta Bee Research Center [28], there are four types of honey production practices, traditional forest, which is placing hives in tall forest trees; traditional backyard beekeeping, in which the honeybees are in a homestead, which is simple to construct, but difficult for internal inspection; transitional beekeeping, where the hive is constructed from timber, mud or locally available materials, and improved beekeeping that is conducted using different types of frame hives.

Honey is produced when foraging bees collect flower nectar using the bee's long, tube-shaped tongue and store the honey in their extra stomach, called a "crop." The bees use their crop to begin to digest the nectar [14]. Upon returning to the hive, the bees suck the nectar from the stomachs of other bees into their mouths as they regurgitate it repeatedly. To produce 1kg of honey, a bee is required to fly to 1 million

flowers to carry 40mg nectar on each bee flight with the involvement of 50 million bee flights (www.fao.org).

The harvesting and transport of honey should follow some procedures, aiming at an efficient collection to maintain the honey's original characteristics and quality of the final product. All equipment used for honey processing should be selected to maintain the original characteristics and quality of the honey, and should be clean to avoid any possible contamination of the product by any substances found there.

Many methods are available to separate bees from their honey combs. Honeycombs can be taken out one at a time and bees may be removed by shaking and brushing. Whole supers can be cleared of bees with a strong air blower. In order to avoid contamination, the honeycombs should not be directly placed on the ground. The beekeeper should place them directly in a special transporting barrow, from which the base is preferentially a stainless steel tray or other material appropriate for food. Once the honey is safely inside the honey warehouse, then the extracting process can begin; the honey warehouse ought to have consistence temperature between 70-75 degrees; use uncontaminated and clean capping forks, capping rollers, hot knives etc, for honey capping or it can be sited the uncapping on a screened pan and leave to drain over night; After the cappings drain overnight, place it into a Cappings Spinner, and spins all day while extract and continues to sling the honey from the cappings and when the cappings are emptied the next morning they are dry like corn flakes and this protects loss of honey; the extracted honey drains into a stainless FDA approved Tank fitted with float and pump and settled the honey for 24 hours to make ready for bottling. The corn flakes cappings added into the wax melter and straining the wax for candles and blocks for retail.

In Ethiopia, traditional beekeepers separate the bees from the honey combs by putting smoke to the hive, the modern beekeepers use brush and few use air blowing to remove bees from the combs and collect in a stainless steel tray or clay or wooden made pots. The beekeepers transport their product to market or recipient collectors when the quantity is small carrying men on their shoulder or head and women at their back however, if the amount is beyond physical ability, they use either animals (donkey or horse) or vehicle that depends on the transport cost and accessibility. The collectors submit to processor and the processors follows the same method stated on the above paragraph. Glass jars and plastic bottles are the main packaging tools used by honey processors.

The export procedures of honey in Ethiopia follow the following pattern: registering with the Ministry of Trade and Industry for the business; obtaining an export license from the Ethiopian Chamber of Commerce and Sectorial Associations; acknowledgment of receipt of the order from a buyer; finalizing of export contract (methods of payment for the export consignment, and submission of copy to the respective commercial bank); submit of application to receive an export permit from a commercial bank; registration of export consignment by filling customs declaration annex form from a commercial bank; application for quality testing and certification by the Ethiopia Conformity Assessment Enterprise or Bless Agri Food Laboratory Services PLC, compliance with tariff schemes from the Customs Authority; insurance of export cargo; customs declaration from the customs authority and other identified information that may be related to the export of honey for a special permit from the Ethiopia Food and Drug Authority.

Table 1: aggregated honey production in Ethiopia from 2014—2017; source FAOSTAT

Country	*Harvesting year*	*Aggregated honey product (in tons)*
Ethiopia	*2014*	*50,000*
	2015	*59,000*
	2016	*48,000*
	2017	*50,000*

Many tropical countries have successfully processed and marketed crude honeys using producers, cooperatives and small-scale processors. Processing crude honey has been also proved in improving honey quality and better utilization of resources. It is possible honey to be harvested even from traditional and transitional hive, to process and market to produce a better quality table honey [10]; since a traditional hive honey is a good quality as far as it is in the hive to the perspective forage. The inferior quality of honey comes from mishandling of the product starting from harvesting, collection, storage, transporting, processing, through to the consumer. Some regions in Ethiopia have gourd, earthen pot, plastics, and animal skins as the most important honey storage materials. Once the honey is produced it should be handled properly to maintain its quality for a longer time so as not to be affected by temperature fluctuations and humidity as those are the most relevant environmental factors that can deteriorate the quality of honey.

Honey in Ethiopia is stored at temperatures between 10 and 20°C to keep the honey bright golden with no hints of dark tints that come only when temperatures go above or below this level. Honey is transported under the above conditions special while transporting by trucks. The storage methods for Honey is that the storage containers for liquid or crystallized Honey should be made either of glass or stainless steel or coated with food approved plastic, paint or beeswax. Even though containers that have been previously used for toxic chemicals, oils or petroleum products are not used for storing any bee products, even after coating with paint, plastic or beeswax but because of poor regulatory practice, some are using them.

The Ethiopian processed honey has been packed in crystal clear honey pots made of glass. These start with 20 gram bottles that come with cork lids for enhancing the freshness of the product. Other identified packaging including large corked bottles of 1kg. Each package is wrapped carefully in polyethylene lined cartons before shipment. Other general information has been identified on Honey packaging where bottle or package should be leak proof and airtight so as to safely contain the Honey, this should also present the product in an attractive form, enticing the consumer to buy it. The label, container shape, and material or other packaging material should be chosen accordingly. Labels should provide all legally required information and preferably a lot number to help the producer track down any problem. Some information may be provided to the consumer on the various uses of the particular product in addition to the legally required information. One identified value-added form for honey consists of packaging small portions for hotels and airlines or of special gift packages with honey of different colors and origin, or of special containers such as clay pottery. Plastic straws, flexible plastic bags, aluminum, and plastic envelopes or inside soft plastic in the shape of animals may be used to pack single portions. Most retailing of pure Honey, prefer packing material such as glass followed by plastic or, for large quantities, metal containers coated with materials appropriate for contact with acidic food. Containers have to have a secure airtight lid. Screw top lids on glass jars are the most secure. Heat-sealed plastic and aluminum lids on plastic cups are fairly safe as well. Half and one-liter flexible polyethylene bags have also been identified to be used in several countries for many years. They are extremely economical to ship but require that the consumer has a special outer container suitable for holding the honey or the honey bag. Recycled

glass bottles may also be appropriate if they can be cleaned adequately and a cork-type seal can be provided. If bottles are cleaned with soap they have to be rinsed many times

2.2 Main Production Areas and Product Map:

Even though there is a difference in potential, all regions have the flora and fauna for beekeeping hence, honey is produced in almost all parts of Ethiopia with twice and in some rear places even more than twice yearly harvesting seasons.

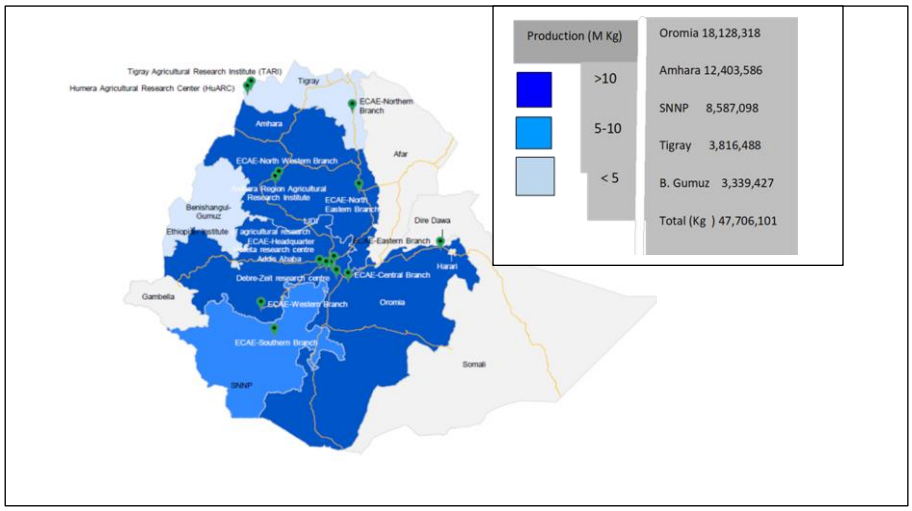
The most important honey and beeswax producing regions in Ethiopia are Oromia, SNNPR, Amhara, Tigray and Benishangul-Gumuz. These areas hold the majority of honeybee populations in the country with their distinctive regional honey character. The data obtained from the Ministry of Agriculture, Department of Honey Sector with reference to the Central Statistics Agency is:

Table 2: Honey production 2018/2019; source Ministry of Agricuture

Geographic area / regions	***All beehives***		***Average Annual Harvesting rate***
	Number of hive	*Aggregated annual honey production (tons)*	
AT country level /Ethiopia	*7,057,188*	*58,588,153*	*2*
Tigray	*331,407*	*4,941,200*	*2*
Afar and Somale	*3,863*	*146,956*	*2*
Amhara	*1,208,124*	*10,629,137*	*2*
Oromia	*3,634,008*	*26,787,107*	*2*
Benshangul - Gumuz	*574,134*	*2,909,490*	*2*
South Nation nationality and people (SNNP)	*1,227,546*	*11,171,645*	*2*
Gambela	*75,265*	*1,989,471*	*2*
Hareri	*1,077*	*6,077*	*2*
Dire Dawa	*1,764*	*7,070*	*1*

The honey belt zones of Western and Southern parts of Ethiopia produce the lion's share of bee keeping products. There are abundant apicultural resources, particularly in the South Western and South Eastern zones of the country including zones like Jima, Illubabor, Bale, West Wellega, Keffa, Benchi Maji, Sidama and Gedeo zones [39].

Figer1: The Ethiopian honey products map: source, from National Quality Infrastructure Development Project funded by World Bank



Ethiopia has got a 50Million USD lone for the purpose of transforming the national quality infrastructure to the scope agro processing, leather and textile to boost the export. Gaps have been identified on the specified sectors.

2.3 Domestic markets: distribution, downstream industries, consumption

Ethiopia has a strong domestic honey market. The most famous and demanded in terms of color and taste originates from Tigray and the Highlands of southwest and southeast Ethiopia. The honey's pure white color is due to bees foraging on Tebeb plant [Basium clandiforbium]. There is also a yellow honey, which is referred to as multi-flora honey, and it is commonly produced and available in almost all regions of Ethiopia. The third type of honey is referred to as Lalibela honey and is produced in central Ethiopia; its main characteristics are light color and fine creaminess that come from bees foraging on acacia trees. There is also less demanded honey with dark brown color and bitter in taste that makes it less sought after for consumption [2]. The other type of honey widely produced and marketed is crude red honey, which is commonly used for the production of local honey wine, the so called "Tej"[39].

Mono-floral honey derived from one particular source of bee forage is more demanded than honey derived from many types of mixed bee forages, as mono-floral honey has its own distinctive aroma, taste, flavor, physicochemical and medicinal properties linked to the source of bee forage. Because of their organoleptic peculiarities and medicinal properties, the demand for mono-floral honey is steadily

increasing in the world honey market. Today there are several well-known mono-floral honeys around the world and Ethiopia as indicated in Table 3.

Table 3: Some major mono-floral honey source of plants, and their distribution areas in Ethiopia: source The API News, Volume 7 Number 2, June 2020

No	Mono-floral honey source plants	Distribution areas
1	Schefflera	Ilu-Ababora, Ji-ma, Guji, Masha & Andracha, Kaf-fa
2	Croton macrostachyus	Ilu-Ababora, Ji-ma, Kaffa, Guji, Bale, Wollega, Bench Maji, Benshangul & Gumuz, Gojam
3	Guizotia scabra	Shoa, Gojam, Wollega, Benshangul and Gumuze, Illu-Ababor, Jima,Gonder, Tigray, SNNPR
4	Eucalyptus spp.	Shoa, Gojam, Gonder, Tigray, SNNPR
5	Becium grandiflo-rum	Tigray, North & South Wollo, Wag-Humra
6	Hypoestes forskaolii	Tigray, Wag-Humra, North Wollo, Central and Southern parts of Rift valley
7	Vernonia spp.	Wollega, Illuba-bor, Jima, Kaffa Bench-Maji, Benshangul and Gumuz
8	Syzygium guineense	Kafa, Sheka, Ilu-Abababor, Jima, Kaffa, Guji Wol-lega, Benshangul and Gumuz and Bale
9	Erica arborea	Gonder (Debark), Bale highlands, West Shoa (Wonchi)
10	Acacia spp.	Tigray, Gonder, Wag-Humra, Benshangul, Afar, Somalia, Borena, Gambela

As to the study [7], in Ethiopia, local processed and packed table honeys mostly affects from granulation and problems associated with granulation like: coarse crystallization, different layer formation, fermentation and the resulting gas bubble production; Crystallized honey ferments more readily than liquid honey for fermentation; when dextrose crystals are formed in the honey the liquid phase has higher water content than the entire honey had when it was uniformly liquid; hence, honey in the uniformly liquid form is safer from fermentation than the crystal one. Most local people associate coarse honey crystals with adulteration of honey with table sugar.

In Ethiopia, about 10% of the honey produced in the country is consumed by the beekeeping households [18]. The remaining 90% is sold for income generation and of this amount, it is estimated that 80% is used for tej brewing [19]. According to [11], domestic honey consumption is increasing due to highly increasing demand for tej, increased consumption of processed table honey in most urban areas and increased demand for honey in the local industries. The domestic honey market starts at the smallholder beekeepers levels, who mostly sell crude honey to collectors in the nearest town/village markets. Therefore, the producers are price takers. The collectors mainly pass the honey on to the wholesalers in big cities and towns, though a

significant amount of honey they collect also goes to local tej brewers, processors and other consumers [8]. In some areas, beekeepers form producing and marketing cooperatives to cope with the market challenges they face. The cooperatives collect crude honey from their members and sell to processing companies and other intermediaries who buy in bulk and for retailing. However, in many cases the cooperatives lack proper collection, storage and transportation facilities and, hence, compromise the quality of the honey. They also have low business concept (market information gathering and analysis, pricing, promotion, etc.) to be competitive [8].

The whole domestic honey market lacks proper structure that is suitable for regulation and, because of this, the market chain is exposes to a lengthy chain, when such structure developed, the producers will not be closer to consumers to dictate the market hence, neither producer nor consumer is benefited from the high price. Consequently, the beekeepers complain that the business is not rewarding and that even the marketability of their product lags behind due to retailers unfairly incurred high prices to consumers. The long market chain encourages smuggling, adulteration, micro-organisms (bacteria, yeasts and moulds) contamination that affects the quality of the product and pushes legal business actors out from the market.

2.4 Main export products and export markets

Even though the contribution of honey and beeswax to the Ethiopian export market is very low, taking the suitability of the environment and climatic condition in to account, the country can also consider the items (honey and honeywax) as having high of export potential as an economically empowering sector for household farmers, and it also creates significant job opportunities for small and medium sized enterprises by engaging in the production, collection, processing, distribution and retailing activities. As per information from the Ministry of Trade and Industry, the export trend of honey and beeswax for the last three years (2017/18 to 2019/20) looks as in Table 7.

Table 4: Export volume of honey and honeywax currency generated from 2017/18 to 2019/20 .source: Trade and industry				
Year	**Honey export Volume in k.g**	**Value in USD**	**beeswax Volume in k.g**	**Value in USD (aggregate)**
2019/20	152,142	522,063	284,505	2,177,753
2018/19	134,430	478,740	283.180	2,407,050
2017/18	316,300	938,550	358,700	3,040,810

From the above table 4, the Ethiopian honey and beeswax export volume compared to the annual production (47 to 50 tons) per annum is very low. Major export destination countries of honey and beeswax are Norway, Sudan, Qatar, the United States, Israel, Yemen, Germany, Japan, China and other countries with smaller volumes.

Table 5: The export volume by countries from 2016/17 to 2019/20; source Ministry of Trade & Industry					
Importing countries	**Export Year in tons**				
	2015/16	2016/17	2017/18	2018/19	2019/20
Norway	244.44	120.15	59.82	82.8	104.40
Sudan	115.88	82.54	75.36	21.20	38.47
Germany	85.04	20.96	82.55		--------
United Kingdom	64.81	73.08	22.38	20.894	0.20
France	---	62.74	------		-------
Somalia	57.07	66.32	67.41	4.6	---------
Japan	4.90	4.10	3.77	0.681	1.13
Israel	------	------	1.02	1.0	2.60
Iraq	----	7.50	-------		--------
Djibouti	10.54	0.21	-------	0.555	--------
Yemen	7.16	1.64	3.00	1.25	2.00
Saudi Arabia	2.68	3.19	0.30		0.10
United States	0.02	0.93	0.32	0.725	3.01
Australia	-------	------	0.37	0.095	-------
Italy	------	------	-----	0.35	--------
Netherlands	0.01	1.64	------	0,003	--------
Belgium	------	-------	------	0.28	-------
Qatar	---	-----	-----	------	0.24
Total	592.53	444.10	316.30	134.43	152.142

From the data, the export volume of honey didn't show a trend of consistent development, rather it continually declined from the total production of 592.53 kg in 2015/16 to 134.43 kg in 2018/19 and slightly started to rise again in 2019/2020. The arguments given for the inconsistency of the development or decline of the export

volume are quality failure and, noncompliance with the destination country's regulatory and customer requirements. Beside this, the export destinations is not covering many countries, hence, it needs promotion of the product to extend market options once the products maintain the applicable quality standards.

In Ethiopia, even though the exact honey imported figure or data is not able to be obtained, because of poor packaging and labeling of local honey, there is significant honey imported for high-star hotel customers.

2.5 Economic and social significance

Because of its climate diversity, Ethiopia has a large potential for beekeeping products; the activity of beekeeping has been exercised at household level and hunting in the forests has been started from the very ancient time. Beekeeping is an important economic source, the sector contributing around $1.6m annually to the national economy (https://www.tridge.com/guides/honey/ET). Other studies [21] strengthening honey and beeswax are becoming one of the major export products and this argument is supported by the factual data which is about 645.36 tons of honey exported and generated $2.23m and 466.69 tons of beeswax exported and generated $6.49 m in 2015 (Custom and revenue authority, 2015). This proves the production of honey and beeswax provides an alternative income source for smallholder farmers, who traditionally also grow cereals, pulses, oil seeds, chilies and other crops.

Ethiopia has more than ten million beehives, and around two million people are engaged in the value chain [29]. Ethiopia is Africa's largest producer of both honey and beeswax and also the fourth largest producer of beeswax in the world (Allafrica.com, 2009).This shows, if the sector can be supported to produce honey based on scientific knowledge, skill and technology then, productivity and quality can easily be enhanced and ultimately many people can be lifted from poverty.

2.6 National development strategies, initiatives or plans

The Government of Ethiopia has established a conducive policy environment for the apiculture sector under the Agriculture Growth and Transformation Plan (GTP) (MoFED 2010), among which proclamation 660/2009 provides for Apiculture Resources Development and Protection, Draft Regulation of Apiculture Resources Development and Protection, establishment of a new Apiculture Research Division at a national level, direct involvement of honey exporting enterprises in the current

Residue Monitoring Plan (RMP) and establishment of the Animal and Plant Health Regulatory Directorate are the major policy directives [33].

As per the Federal Democratic Republic of Ethiopia Growth and Transformation Plan II, assessments of Growth and Transformation Plan I (GTP I) were undertaken and articulated through four overarching objectives: (i) maintaining at least an average real GDP growth rate of 11% per annum and attaining the Millennium Development Goals (MDGs) by 2014/15; (ii) expanding access and ensuring the qualities of education and health services and achieve MDGs in the social sectors; (iii) establishing conditions for sustainable nation building through the creation of stable democratic and developmental state; (iv) ensuring the sustainability of growth through maintaining macroeconomic stability. These four overarching objectives were in turn cascaded down in-to seven pillar strategies that cut across all socioeconomic sectors [22].

The Sustainable Development Goals were integrated and implemented in the GTP II, especially Goal1 "End poverty in all its forms everywhere" was stated in the policy as the principal development objective for Ethiopia, besides diversifying the economic and export structure as well as creating a green resilience economy.

The second Growth and Transformation Plan (2015/16-2019/20) was considered as important vehicle of transporting to the Ethiopia renaissance by reversing the down fouling of the economy that had happened for many years with resilience economy. Accordingly, the Government is fully committed to mobilize the necessary resources including capacity for implementation of the Plan. Modernization in the development of the agriculture sector, expansion of industrial development with a primary focus on light manufacturing, a significant shift in export development, were at the core of the GTP II [22] .

The development of the Ethiopian honey industry when it is measured from its potential contribution to goal one in the Sustainable Development Goals (SDGs) is encouraging, because it engages many household farmers and also enhanced the country to have diversified export items. The indicator for its contribution to the national economy development can be taken as witness to the first GTP-I period, honey and wax processing and export contributed $26.77 m [6].

The Ministry of Trade and Industry has develop a strategic plan called "Globally Competitive Honey Industry in Ethiopia" operationalized by the Ethiopian Meat and

Dairy Industry Development Institution. However, as per to the information from the institution lab, the institution has facility limitations to support the honey industry in terms of conducting problem solving research and providing third party external quality assurance services.

Generally, the strategic direction has been focused on making dramatic productivity improvements and product differentiation and on upgrading strategies. The productivity improvement involves two directions:

- Developing and managing apiary site, which would ensure sufficient and sustainable forage for the bees to create the possibility of equally productive multiple harvesting.
- Hive selection and colony management for the improvement of quality and quantity of the Ethiopian honey product.

Table 6: Currently active honey and beeswax processing industries in Ethiopia: source Ethiopian Meat and Dairy Industry Development Institute.

S. N	Company name	Annual processing capacity, ton	Warehouse capacity in ton	Location of the company
1	Beza mar Agro Industry PLC	1,000	100	Oromia / Adama
2	Emebeat commercial	73	73	Addis Ababa
3	Dimma Beekeeping PLC	450	450	Tigray / Adigrat
4	Shekordic Honey and wax development industry PLC	547.5	6	South / Sheka
	Cumel P.L.C	200	1,000	Tigray / Mekelle
7	Zenbaba Bee product union	200	400	Amahara / Bahredar
8	Gula Bee's product youth union	1,000	1,500	Addis Ababa
9	Babicho Agro Industry private limited association	250	250	Oromia / Lekemte
10	Apinak Agro Industrial private limited association	300	300	South / Bonga
11	Rekesho Honey and beeswax Trade PLC	500	500	Oromia / Jima
12	Aguneta Association	9.4	40	Amahara / Bahredar
13	Kefa Union	52.5	40	South / Kefa
14	Abesina Abe Industry PLC	300	300	Amahara / Bahredar
15	Genal Miges Trading	72	100	Oromia / Adama
16	Tesfay beeswax PLC	100	1,000	Oromia / holeta
17	Jorje Eftamu PLC	200	-	Oromia / Metu

3 Global Market Analysis

3.1 Analysis of Domestic Market

3.1.1 Overview of Domestic Industry: Ethiopian honey is sold in crude form (honey and wax comb together) to tej producers, traders, retailers and local consumers.

Moreover, evidences indicate that the amount of honey exported is comparatively low and less than 1% of the total produced.

Honey collectors mostly collect honey at farm gate and at local markets. They move door to door and also appear on local markets to maximize their purchase. After bulk purchase, they pass/sell to different consumers like tej houses, retailer shops, whole sellers, cooperatives, union, processing companies and also smuggle to Sudan and Eritrea. As per to [23] considerable amount of honey goes out of the region through Mekele and Axum airports, being purchased from retail shops, cooperatives, union and processing companies.

Until recently, honey produced in the country was used to almost satisfy local demand and often used in the: production of "Tej" alcoholic mead consumed locally. However, since 2008, Ethiopia is listed as EU 3rd country with privileges of exporting honey to Europe. Therefore, the country is exporting honey to different countries, such as Sudan, Norway, Saudi Arabia, Yemen and others.

In spite of honey, beeswax is one of the traditional agricultural commodities the country has been exporting for a long time. The country is the 4th biggest beeswax exporter to the world market.

According to the information from SNV-Ethiopia, there are 17 companies registered as exporters of beeswax in the country. However, most of them are not active. The lack of supply is mentioned as one of the reason for many of them to remain inactive, not the absence of international markets. The current high local market and super market prices as compared to the export price is also one of the reasons for remaining inactive. Companies listed as honey exporters above are also recognized in exporting beeswax.

In almost all Ethiopian regions, honey and beeswax marketing is done mostly by the people who are not licensed and have no competence certificate. Honey and beeswax are considered additional commodities along with other commodities like butter. Although there are specific requirement for honey and beeswax trading under proclamation 686/2002, it usually practiced mixed with other products, such as butter and other spices (example: long paper (Timiz) and Ethiopian cardamom, etc.), except in a few regional capital cities, such as Mekelle. As a result, it is very common to find shops by the name of honey and butter in many towns of the region.

3.1.2 Overview of Role in Global Market

As per to Buckwheat Honey Market Study, the international honey market is drastically influenced by geo-political and macroeconomic factors; the market is formulating by immersing the currency and zero interest rates, in which depositors in Europe pay "interest" to banks to hold their deposits, an unstable global market economy, military conflicts, and climatic volatility; nowadays, the more tendencies for production of pure honey is increasing, the more producers in the international market raise investments for exporting to US market, which is the most preferred consuming market for international honey exporters. This favorable situation is a reflection of both the perception of relative economic stability and USD [16].

Medical use of honey will continue to expand business opportunities for manufacturers, unifying pharmaceutical production with honey production. Drugs containing honey are equipped with key trace elements having wound-healing properties. Hydrogen peroxide, methylglyoxal and other compounds that are present in honey can be used in production of antibiotic drugs, compelling researchers to devise more accurate studies on medical uses of honey. Effectiveness of honey-derived drugs will inflate its presence in healthcare measures across the world [41].

3.2 Analysis of International Market

3.2.1 Overview of Global Market

3.2.1.1 Global production: Total world production of honey has increased from 1799,000 metric tons produced in 2014 to 1,872,000 metric tons by 2017. This increase might be due to the increase in beekeepers and honey production in various countries as a result of increasing consumer demand.

The production of honey has no similar trend of growth in each region. Asia is the largest producer of honey compared to other regions, and next Europe, followed by America, then followed by Africa, keeping behind Oceania.

Table 7: Global Honey production from 2014 to 2017: source FAOSTAT

Area	Yearly Exported in ton			
	2014	2015	2016	2017
World	1,799,000	1,829,000	1,865,000	1,872,000
Europe	373,000	424,000	387,000	391,000
Asia	817,000	838,000	911,000	922,000
America	353,000	321,000	336,000	334,000
Oceania	31,000	33,000	33,000	27,000
Africa	223,000	213,000	198,000	198,000

Even though honey is produced everywhere in almost all countries, the contribution in the global honey market is dominated by few countries as shown on chart 1. The major ten contributors to the global honey production as per the data on chart 1of the year 2018 are China, Turkey, Argentina, Iran, Ukraine, United States of America, India, Russia, Mexico and Ethiopia.

. Chart 1: Leading producers of natural honey worldwide in 2018 (in 1,000 metric tons)* Source Statista

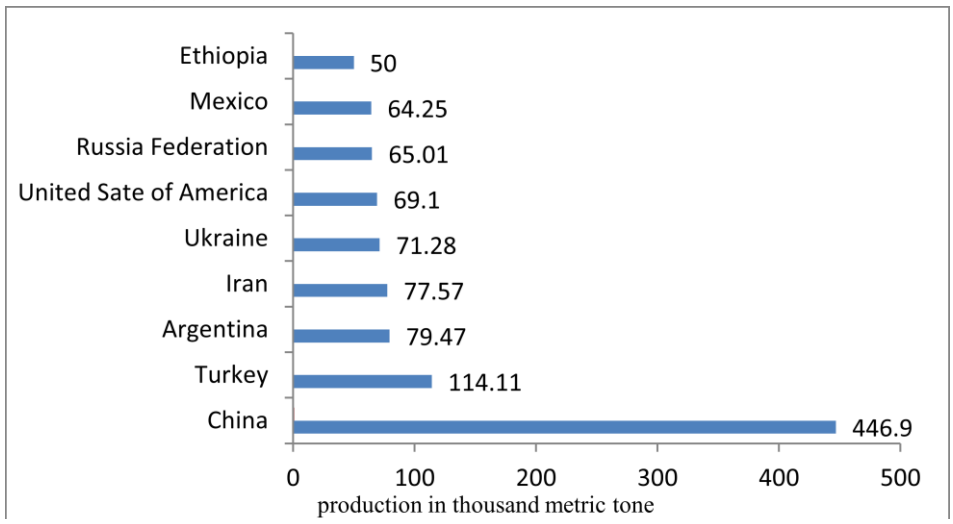
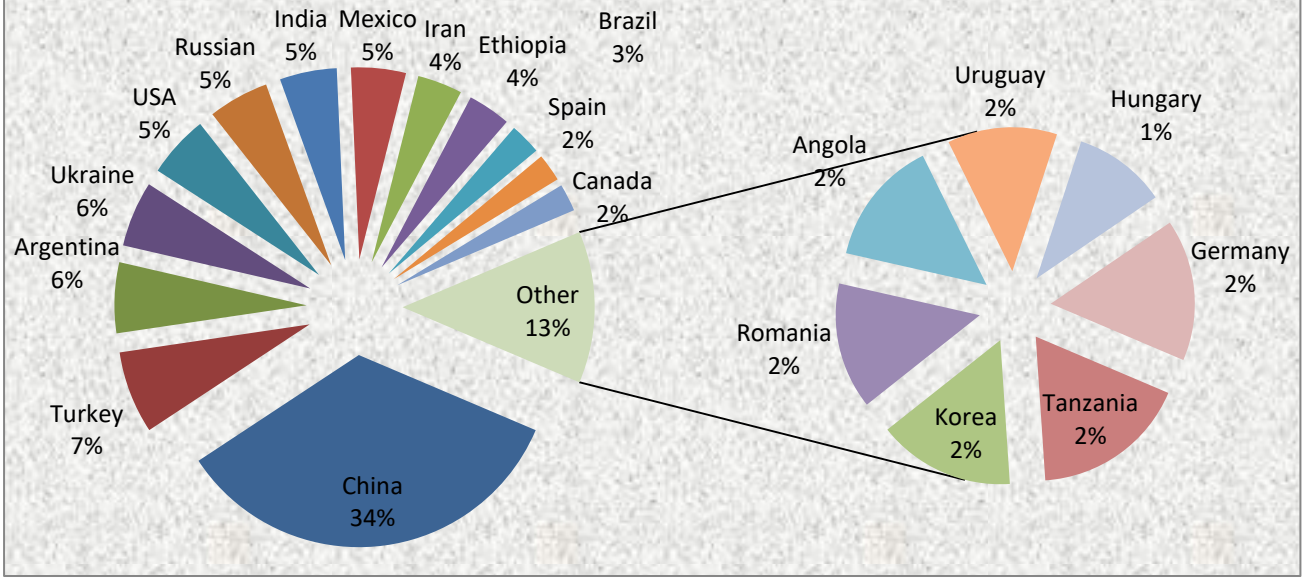


Figure 2: Global share of the top producers of honey in 2012 Source: Ethiopian honey strategic plan rferered its source FAOSTAT



3.2.1.2 Global Consumption

According to the U.S. Company Global Industry Analyst (GIA), the global market for honey has been exceeded 1.9 million tons by the end of year 2015. This is because of the consumer's awareness on the health value and natural food product of honey. More ever, several honey producers are launching new products and varieties at

regular intervals. The increasing trend of organic and healthy spreads is expected to continue giving rise to new varieties and flavors in the global honey market. Increasing preference amongst consumers for honey-based products, is leading to a boost in the variety and assortment of honey based food products, baby products, yogurts and drinks. Moreover, honey contains antioxidants, minerals, vitamins and proteins, making itself an appealing ingredient as compared to artificial sweeteners. However, as per Buckwheat Honey Market Study, Asia is the major honey consumer with 38% of global consumption, followed by Europe continent (30%) and Americas (20%). Africa is consuming about 11% of honey consumed in the world, and the smallest market is Oceania with 1% of market share [16].

3.2.1.3 Global Trade

As per to FAOSTAT export data for the years 2014 to 2017, the main honey exporting region is Asia and the lowest exporting region is Africa.

Table 8: Four Years Honey production, Import, Export Data of Continents and the World; source FAOSTAT

Region		2014	2015	2016	2017
World	Production (tone)	1,799,000	1,829,000	1,865,000	1,872,000
	Import (tone)	618,000	649,000	631,000	695,000
	Export (tone)	630,000	663,000	660,000	676,000
Africa	Production (tone)	223,000	213,000	198,000	198,000
	Import (tone)	9,000	8,000	10,000	9,000
	Export (tone)	3,000	3,000	3,000	3,000
America	Production (tone)	353,000	321,000	336,000	334,000
	Import (tone)	173,000	184,000	175,000	212,000
	Export (tone)	165,000	163,000	186,000	178,000
Asia	Production (tone)	817,000	838,000	911,000	922,000
	Import (tone)	110,000	104,000	102,000	99,000
	Export (tone)	253,000	273,000	233,000	233,000
Europe	Production (tone)	373,000	424,000	387,000	391,000
	Import (tone)	318,000	342,000	334,000	367,000
	Export (tone)	195,000	208,000	225,000	249,000
Oceania	Production (tone)	31,000	33,000	33,000	27,000
	Import (tone)	8,000	11,000	10,000	9,000
	Export (tone)	14,000	16,000	14,000	13,000

If we see the import data of the years from 2014 to 2017, the main contributor to the global honey import is Europe and the lowest contributor is Africa.

Table 9: Global Honey import quantity from 2014 to 2017: source FAOSTAT				
Area	Yearly aggregated Export in ton			
	2014	2016	2015	2017
World	618,000	631,000	649,000	695,000
Europe	318,000	334,000	342,000	367,000
Asia	110,000	102,000	104,000	99,000
America	173,000	175,000	184,000	212,000
Oceania	8,000	10,000	11,000	9,000
Africa	9,000	10,000	8,000	9,000

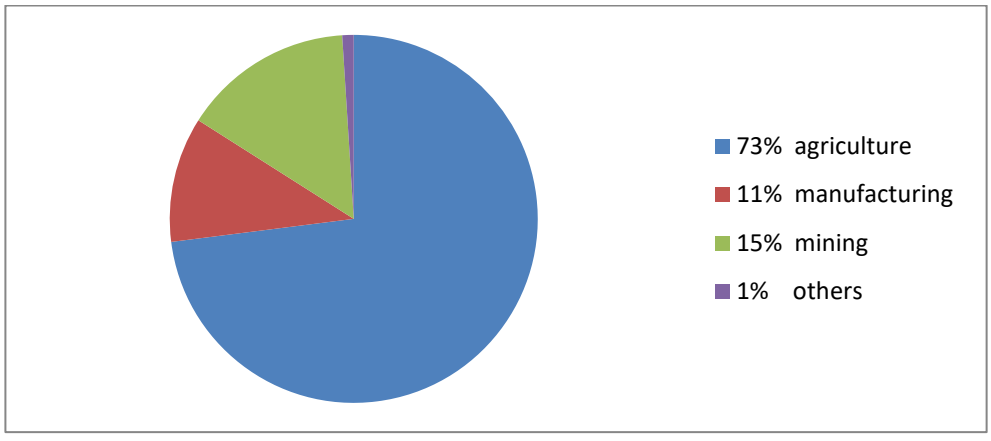
3.3 Market opportunities

3.3.1 Key export markets and main exported products

The world honey market is not an easy one to enter. Exporters have to be up to date with legislative criteria and able to meet them. Despite the lowest price, Beekeepers preferred to sell honey at local market because of non-regulatory and quality requirements to comply compere to cross international border regulations; The Beekeepers can also benefited from market selling price if they can sell directly for consumers.

As per to the Ministry of Trade and Industry export share data of the years from 2009/10 to 2016/17 indicated as the contribution of honey in the export share is very small

Figer3: Ethiopian export item share from 2009/10 to 2016/17



Source: calculated based on the data compiled from Ethiopian Revenues & Customs Authority and Ministry of Trade and Industry.

The export destination of the Ethiopian exported items covered all the continents with variation in volume as shown on Table 10.

Table 10: Major destination continents for Ethiopian major export products in 2016/17			
Continents	Volume	Value	Value Share in %
Asia	718,978.36	1,126,468.93	38.75
Europe	210,885.00	834,782.21	28.71
Africa	686,961.13	623,658.39	21.45
America	59,244.21	219,701.30	7.56
Oceania is	5,430.04	25,134.30	0.86
Others	1.85	77,581.06	2.67
Total	1,681,500.59	2,907,326.19	100.00
Source: - Calculated based on data from the Ethiopian Revenues and Customs Authority by Ministry of Trade & Industry			

The Government of Ethiopia had developed a strategic plan that forecasts to boost the export volume by assessing all the possible efforts to extend the destination areas and exportable types of items. However, the outcome is not as expected as shown by the performance over eight years from 2009/10 to 2016/17.

Table 11: Overall Export Performance of Different Sectors (2009/10-2015/16) Revenue '000 Dollars Performance achievement												
Budget Year	Agricultural Sector			Manufacturing Sector			Mining sector			Other sector		
	Target	Achievement	Growth %	Target	Achievement	Growth %	Target	Achievement	Growth %	Target	Achievement	Growth %
2009/10	2338234	1562647		349120	1226916		172716	291148.9		67773	23055	
2010/11	2452921	1944388	24.4	410688	258211.6	110.5	330139	495782.9	70.3	44411	53826	133.5
2011/12	3067550	2202177	13.30	658153	306376.5	18.7	820851	627487.8	26.6	13316	16650	-69.1
2012/13	3386707	2142222	-2.70	247371	325610.8	6.3	845469	596403.9	-5.0	6375	16970	2.0
2013/14	3291635	2393246	11.7	099351	365618.1	12.3	1042274	475781.5	-20.2	38304	25354	49.4
2014/15	2882702	2231997	-6.70	1507867	389090.5	6.4	646782	362996.2	-23.7	--	11892	-53.1
2015/16	2,753,966	2,154,920	3.45	869900	344478.4	11.47	600000	310539.98	-14.45	--	46720	--
2016/17	3,034,212 2	2181005	1.21	916847	412938.8	19.87	718620	230795.7	-25.68	80600	82587	76.77
Total	290,099,1 2	2101575	4.88	619993	315626.91	18.93	647106	423867.1	-3.26	41796	34632	19.99
Source: calculated based on the data compiled from Ethiopian Revenues & Customs Authority by Ministry of Trade and Industry												

Ethiopian products have been imported by different countries, as per the Ministry of Trade and Industry data of the year 2016/17, the number of destination countries for cereal exports was 10 destinations, for textile and apparel 57 destinations, for leather and leather products 52 destinations, for Khat 74 destinations, for live animals 16 destinations, for meat and meat products 23 destinations, for natural gum and incense 20 destinations, for flowers 11 destinations, for pulse 62 destinations, for coffee 58 destinations and for oil seeds 16 destination countries. However, the export volume to

each destination country as shown in table 12 is not to the required level, it needs improvement.

Table 12. Destination areas for major exportable items on 2016/17. Source Ministry of Trade and Industry

Destination countries	Leather and leather product in ton	Textile and Apparel in ton	Cereals in ton	Natural Gum & incense	Meat & meat products	Live animals	Khat in ton	Flower in ton	Coffee in ton	Oil seed in ton	Pulse in ton	Vegetable & fruits
Kenya	470..3	270.4	68,247.5	--	---	----	---	----	--	---	46,414.20	
Israel	--	--	1,832.9	---	----	----	86.6	----	--	48,583.91	--	
Djibouti	--	--	84.3	---	---	51,056.0	7,901.6		--	---	--	90,600.5
Somalia	--	--	--	---	--	58,762.0	40,518.3	--	--	---	--	109,479.7
America	1,231.9	3,156.8	23.1	---	--	--	--	633.2	20,698.14	20,199.1	--	
China	2,676.3	1,468.9	--	936.0	--	192.0	--	--	1,678.38	160,074.7	--	
Canada	87.3	69.0	66.0	--	--	--	3.5	68.9	1,652.04	---	--	
Germany	--	2,845.0	17.5	275.5	--	--	--	317.9	40,301.52	---	--	226.6
Great Britain	138.8	350.7	25.0	--	--	--	--	--	--	---	--	
South Africa	--	--	0.5	--	--	--	9.2	--	--	---	10,229.47	
Norway	--	177.3	--	--	--	--	--	1.252.7	--	---	--	
Turkey	--	2,617.2	--	--	--	--	--	--	--	12,542.0	10,579	
Australia	--	212.8	0.3	--	--	--	--	--	4,615.38	---	--	
Saudi Arabia	--	--	1.5	--	6,309.8	129,342.0	--	2,234.8	36,551.31	3,021.8	--	542.6
Japan	--	59.7	--	--	--	--	--		--	---	--	
United Arab Emirates	77.5	233.9	--	191.0	10,710.4	9,717.0	--	869.2	--	18,972.32	23,339.13	592.2
Bahrain	--	--	--	--	1,068.1	1,068.1	--		--	---	--	
United Kingdom	--	--	--	--	--	--	--	2,037.1	6,238.04	4,572.0	--	595.3
Japan	8.6	--	--	--	--	--	--	693.6	26,862.75	4,655.0	--	
Netherland	--	73.7	--	--	--	--	--	39,701.3	1,378.71	----	--	1,818.12
Bangladesh	--	396.6	--	--	22.4	--	6.5	--	--	----	--	
Cambodia	--	--	--	--	--	--	8.3	--	--	----	--	
Nigeria	--	--	--	--	--	--	6.0	--	--	---	--	
S. Korea	--	--	--	--	--	--	--	--	11,436.78	3,206.1	--	
Pakistan	--	--	--	--	--	--	--	--	--	---	58,719.8	
Spain	--	39.0	--	--	--	--	--	--	1,939.23	---	--	
Egypt	--	--	--	--	--	6,880	--	--	--	---	6,249	
Indonesia	39.6	300.4	--	--	--	--	--	--	--	---	22,501	
Swaziland	--	300.0	--	--	--	--	--	--	--	---	--	
Italy	249.8	1,014.0	--	--	--	--	--	186.9	10,796.30	---	--	
Vietnam	44.9	--	--	1,166.9	804.1	804.1	3.0	--	--	15,420.2	54,402.7	
Yemen	15.5	--	--	--	--	--	--	--	--	6,950.5	11,314.2	
Qatar	--	--	--	--	40.0	6,053	--	---	--	---	--	
Libya	--	--	--	--	--	2,619	--	--	--	---	--	
Oman	--	--	--	--	62.7	--	--	--	--	----	--	
Comoros	--	--	--	--	27.2	--	--	--	--	----	--	
Kuwait	--	--	--	--	11	4,044	--	--	--	----	---	
Rwanda	--	--	--	--	--	30,000	--	--	--	----	---	
Belgium	--	--	--	--	--	--	--	274.1	19,548.82	----	--	
Bosnian Herzegovina	--	--	--	--	9.8	--	--	--	--	----	---	
France	17.1	643.5	--	--	--	--	3.3	--	10,575.05	----	--	
Sweden	12.8	--	--	--	--	--	--	--	2,336.76	----	---	
Hungary	7.6	--	--	--	--	--	--	--	--	----	---	
Romania	5.5	--	--	--	--	--	--	--	--	----	---	
Hong Kong	521.3	--	--	28.0	--	--	66.9	--	--	2,280.0	--	
Thailand	45.6	--	--	--	--	--	--	--	--	---	--	
India	151.5	--	--	120.0	--	--	95.2	--	--	3,132.2	57,607.51	
Qatar	--	--	--	--	--	1,712	--	--	--	---	--	
Iran	--	709.9	--	--	--	--	--	--	--	---	15,144	
Sudan	--	83.7	--	--	183	67	--	--	11,237.23	---	16,230	410.7
Iraq	--	--	--	249	--	--	--	--	--	---	--	
Tunisia	--	--	--	166	--	--	--	--	--	---	--	
Greece	--	--	--	98.9	--	--	--	--	--	4,655.5	--	
Algeria	--	--	--	43.9	--	--	--	--	--	---	--	
Zambia	--	--	--	--	--	--	11.0	--	---	---	--	
Burundi	--	--	--	--	--	--	5.7	--	---	---	--	
Jordan	--	--	--	15.7	--	191.0	--	--	2,559.90	---	2,089.9	
Guatemala	--	--	--	30	--	--	--	--	----	5,134.0	--	
Taiwan	--	--	--	--	--	--	--	--	2,736.21	---	---	
Russia	--	--	--	--	--	--	--	--	2,791.32	---	9,867.7	246.1

Even though the contribution of honey and beeswax to the Ethiopian export market is very low, taking the suitability of the environment and climatic condition in to account, the country can also consider the items (honey and honeywax) as potentially exportable items and economically empowering sectors for smallholder farmers

holding significant job creation potential for small and medium-sized enterprises involved in the production, collection, processing, distribution and retailing activities. As per information from the Ministry of Trade and Industry, the export trend of honey and beeswax for the last three years (2017/18 to 2019/20) looks as in table 13.

Table 13: Export volume of honey and honeywax generated from 2017/18 to 2019/20.

Year	Honey export volume	Value in USD	Beeswax export volume in kg	Value in USD (aggregate)
2019/20	152,142	522,063	284,505	2,177,753
2018/19	134,430	478,740	283.180	2,407,050
2017/18	316,300	938,550	358,700	3,040,810

Source: Ministry of Trade and Industry

From the above table 13, the Ethiopian honey and beeswax export volume compared to the annual production (47 to 50 metric tons) per annum is very low.

3.3.2 SWOT Analysis

Strengths:- excellent climate suitable for honey farming, availability of bee forage, forest is government public property hence any beekeepers can use it, improved beehives and practices, availability of financial institutions to provide credit to the sector, it accommodates many employees with small financial investments, have unique taste and color (white) with good demand in the national and international market**.**

Weaknesses:- low productivity, limitation of technical support along the value chain, no strong associations engaged in collection and processing at a close distance to the beekeepers or harvesters, no mandatory requirements to be followed and implemented by producers, collectors, transporters and processors, no effective technical regulation, no proper packaging that attracts consumers, processing equipment is expensive, low consumer awareness on honey quality standards and no internationally accepted certifier.

Opportunities:- It has social acceptance as food, medicine and cosmetics; high demand of unprocessed honey; wide bio diversity (bee forage); strong government attention; presence of indigenous knowledge, skills and interest to improved technologies, listed to export to the European Commission, consumed by both Muslims and Christians, and availability of internationally recognized accreditation services at affordable cost.

Threats:- excessive use of pesticides and herbicides in agricultural fields, which are used as bee forage, low regulatory practices regarding the compliance with quality parameters, the product is targetable for adulteration with acid-inverted sugar syrups, corn syrups, and syrups of natural origin (such as maple, cane sugar, beet sugar, molasses, etc.) added to honey.

3.3.3 Cost and Profit Margin Analysis (domestic and foreign market)

Amhara region's honey price is increasing day to day more than ever before. The current price of processed honey is up to 90 birr per kg at Zembaba farmers' cooperative union and 80 birr/kg at Marutie bee products cooperative. It is also within the range of 60-70 birr at farm gate.

- Tigray region's honey price is increasing day to day more than ever before to the extent that it becomes unaffordable for local consumers. The current price of processed extra white honey is 380 birr/kg at Dimma plc and 260birr/kg at Meles cooperatives union. The honey price at farm gate is also estimated to fall within the range of 190-250 birr /kg. Although it seems producers are benefiting from the current price rise, it might not sustainably translate into continued income in the future. Rather, it seems the current honey price rise has given rise to and further stimulated the problem of honey distorting the origin of honey by blending honeys of different agro-ecological zones seeking for a better price.

Oromia region's average price for crude honey at the farm gate is 30- 35 birr/kg while the traders /cooperatives sell with a price of 70-80 birr/kg. Sometimes, those honey collectors sell crude honey to Tej houses with an average price of 40-45 birr/kg. In the Southern Nations, Nationalities, and Peoples' region, the price of honey ranges from 35 birr/kg at farm gate to 80 birr/kg in towns.

3.3.4 Quality standards and requirements at main export markets (EU, Norway, and Middle East): Honey essentially consists of different sugars, predominantly fructose and glucose as well as other substances such as organic acids, enzymes and solid particles derived from honey collection. The quality of honey is measure against the agreed criteria in which the honey shall comply. Honey must meet specific composition criteria on sugar content, fructose and glucose (sum),, sucrose content, moisture content water-insoluble content, electrical conductivity, free acidity, diastase activity and hydoxymethylfufural content.

According to the Codex Alimentarius, honey must meet the following composition criteria when the product is intended for human consumption:

Table 14: Honey Quality Standard parameters and their tolerance limit ; Source PTB, Training Manual, Good Mnaufacturing Practice

S/No	Parameters	Requirements, Codex Alimentarius Commission (CAC)	Testing Methods
1	Moisture content (%) (max)	20.0	IHC(2009:1(10)
2	Ash content (%) (max)	0.6	IHC(2009:3(19)
3	Specific rotation[α]20D	-20.4 to 4.8	IHC(2009:11(61)
4	Total acidity (max)	40 milli-equivalent per 1000 grammes	IHC(2009:4(24)
5	pH	3.42-6.10	IHC(20094(24)
6	Sucrose (%) (max)	5.0	IHC(2009:7(42)
7	Reducing sugar calculated as invert sugar (%) (max)	65.0	IHC(2009:7(42)
8	Fructose/dextrose ratio	106-119:900	IHC(2009:1(10)
9	Water insoluble content (pressed honey) (%) (max)	0.5	IHC(2009:8(55)
10	Water insoluble content (unpressed honey) (%) (max)	0.1	IHC(2009:8(55)
11	Specific density g/litre	1352-1500	IHC(2009:1(10)
12	Diastase activity (diastase number on Gothe scale) (min)	8	IHC(2009:6(35)
13	Electrical conductivity (mS/cm) (min)	0.8	ES 1202:2015, Annex E
14	Hydroxyl methyl furfural content (mg/kg) (max)	CODEX 60 but EU 40.0	ES 1202:2015, AnnexH
15	Fiehes test (detection of technical sugar)	Negative	ISO 12824:2016 annex B
16	Proline content (mg/kg) (min) Honeys with natural low enzyme count	10.0 4.0	ISO 12824:2016 annex A
17	Invertase number (Hadons unit) (min) For Honey with naturally low enzyme count	10.0 4.0	ISO 12824:2016 annex E
18	Lugol's reaction (detection of technical sugar)	Negative	ISO 12824:2016 annex D
19	Lund's reaction Precipitate formed	0.6-3.0	ISO 12824:2016 annex C
20	Total aerobic mesophilic bacterial plate count max. limit in (cfu/g)	1×10^3	AOAC 2012
21	Mould/yeast max. limit in (cfu/g)	$5 X10^1$	AOAC 2012
22	Coliform count	Nil	AOAC 2012
23	E.coli	Nil	AOAC 2012
24	Arsenic (As)mg/kg (max)	1.0	A0AC 2012
25	Copper (Cu) mg/kg (max)	2.0	A0AC 2012
26	Lead (Pb) mg/kg (max)	0.5	A0AC 2012

Note: In the average adult consumers, lead dietary exposure ranges from 0.36 to 1.24, up to 2.43 µg/kg body weight (b.w.) per day in high consumers in Europe

According regulation (EC) No 852/2004, honey business operators carrying out any stage of production, processing and distribution of honey after primary production (beekeeper) have to comply with the general hygiene requirements.

Table 15: Honey contaminants while harvesting, storing and processing		
S.N	problem	substance
1	Microbiology	Toxin, pathogenic germs, yeast
2	Fermentation	Yeast
3	Heavy metals	Lead, Arsenic , copper, etc
4	Ultra filtration (while removing contaminants	Lack of pollen
5	Adulteration	Sugar cane, corn-sirup, rice-sirup

According to the European Council Directive 96/23/EC, there are residues that shouldn't be on the honey product that need continuous monitoring to ensure the absence of the residues in the product.

Table 16: Substances to be monitored in honey (mandatory)		
1	Forbidden substances	Chloramphenicol, nitrofuranes
2.	Antibacterial substances	Streptomycin, Sulphonamides, tetracyclins, Tylosin

Even though the quality measuring criteria and acceptance of testing parameter results, depends on the economic strength of society in the country, the standard used by many countries as a common consensus criteria is either ISO or CODEX standards, and as per their economic affordability, regulatory bodies might have more stringent requirements.

4 in-depth analysis of the honey value chain

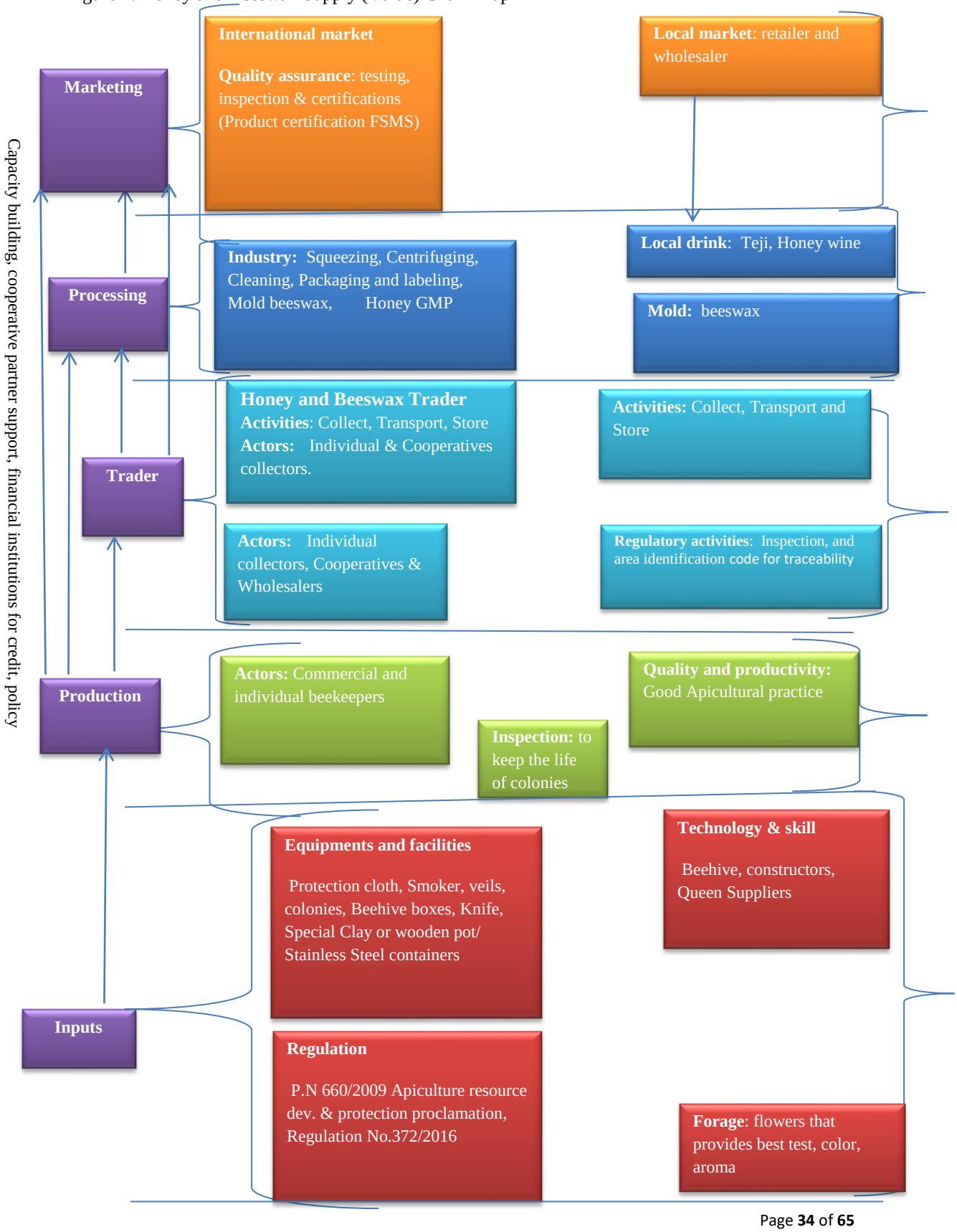
The honey value chain starts from the input of suppliers and it ends with consumption enjoyed by consumers. Hence, to supply enjoyable quality honey to consumers, it needs to maintain the quality of honey across the value chain by developing / adopting requirements for each activity to be followed and comply at each stage of value chain.

4.1 Linkages and main process: beekeeping, collecting, processing, packaging, logistics, retail/export:

In the value chain of honey, it is necessary to identify market actors from producers to consumers governed by modern marketing system that enables to deliver quality honey, easy to trace the source / origin of the honey and supply the required volume on time so as to make the country competent in the international market that ultimately benefited the country by generate sustainable hard currency to the national economic development. Beside this, regulatory bodies shall establish a transparent and accountable system that ensures to address rights and obligations to be followed by the actors so that the market transaction of honey and honey products will be fast, results based, fair, equitable and healthy.

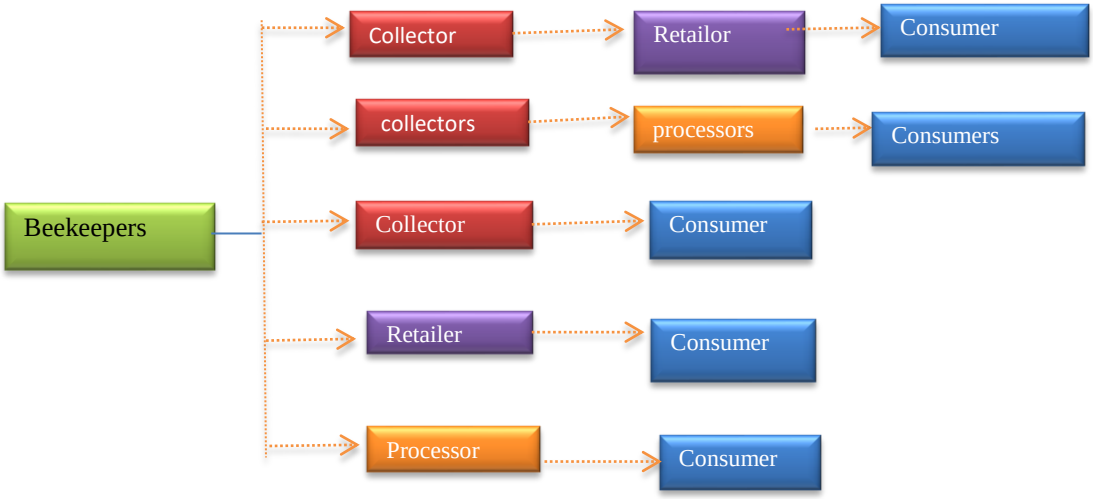
Since honey is sensitive to biological contamination, honey's hygiene shall be maintained along the whole chain from beekeeper to consumer. Primary actors in the supply (value) chain are beekeepers who produce honey.

Figure 4: Honey and Beeswax Supply (Value) Chain Map



In Ethiopia, there are different market channels how honey is supplied to local consumers as indicated in figure 5.

Figure 5: Possible Ethiopian market chains to the consumer



4.2 Description of value chain segments

4.2.1 Input suppliers (hives, packaging materials and other inputs)

Colony producers provide colonies to beekeepers, for this they should have production sites with multiplication and production equipment that meets the criteria that enables beekeepers to maintain the safety of the colony attested by competency certificates and valid business licenses.

Every beekeeper (individual and commercial) shall have the skill to keep, transport and supply his bee product in an appropriate manner to the market designated by the regulatory authority and deliver to the next chain by maintaining its quality.

Since honey is a hygroscopic substance, the bottle or packaging should be leak-proof and air-tight so as to safely contain the honey and also to present the product in an attractive form, enticing the consumer to buy it. The label, container shape and material or other packaging material should be chosen in a way that can be considered attractive by prospective customers. Packaging doesn't improve the quality of the product itself, rather it adds sale value to the product. Labels shall provide all legally required information and preferably a lot number that enables tracing of the product for any investigation. However, the practice shown in Ethiopia doesn't indicate this, mostly, selling honey in the local markets is without labelling and legal metrology is neither doing regulation monitoring nor market surveillance inspection to ensure the compliance of labelling requirements.

4.2.2 Beekeepers: Beekeepers are living in remote areas where there are poor facilities like roads for transport, electricity and others and they encounter many constraints of getting to markets where they can sell their products and purchase inputs for their honey production. They furthermore experience difficulties to receive trainings and technical advice at their sites. Beekeeper use inputs like colony, protection cloth, smokers, veils, hives, knives, clay or / and wooden pots or stainless steel collectors. All the inputs have to be clean and comply with the stipulated requirements.

With the aid of governmental and non-governmental organizations, a number of beekeepers and bee product marketing cooperatives have been established in different parts of the country. The size in terms of membership and the amount of initial working capital varies from individual to individual, from cooperative to cooperative, depending on the living conditions among the members and source of seed money they have; it also depends on the suitability of local micro financing policy that enables loan provision to the sector, while share selling to the members is also serving as a source of money to the cooperatives to be used for the purchasing of beekeeping inputs. .

4.2.3 Intermediaries/traders: Because of small volume and distance from the market, beekeepers do not supply their products directly to processors and /or retailors. Therefore, they supply their products to collectors. The collectors are also expected to maintain the quality of the product, nevertheless, the collections by its process are required to mix different products in one container and this affects the particular character of each product supplied by each beekeeper. The collectors supply the product to local tej and wine brewers, retailors and to industry processors.

4.2.4 Primary / Secondary Processing: Honey shall be processed to a minimal extent in the way that can be sold locally. The process starts from removing the wax cappings of the honeycomb using a long sharp knife that has been heated either by standing it in warm water or keeping it on sunlight. The honeycombs are then broken into pieces and the honey is strained to remove wax and other debris. A fairly coarse strainer is used at first to remove large particles, and then the honey is strained through successively finer strainers such as cotton or muslin cloths. The clear honey is collected in a clean, dry container. When most of the honey has drained (often over many hours depending on the temperature) the combs are squeezed inside a cloth bag

to remove as much of the remaining honey as possible [32] or else leave over night or 24 hours to settle, i.e. air bubbles, wax particles, insect pieces, and other organic debris float to the surface while mineral and heavy particles drop to the bottom [34] The surface scum needs to be carefully removed, or honey can be drawn off near the bottom sediment.

The wax is collected and formed into a block by melting it gently in a warm water bath or solar wax extractor. This beeswax byproduct often has a high value as a wax polish or for candle-making. The strained honey can either be dispensed from the collection pan into customers' own containers or packed into glass jars or plastic bags for sale [32]. On the other hand the honeycomb can be scratched and put to a centrifuge so that the honey will be separated from the wax.

It is advised that containers for liquid or crystallized honey be made either of glass or stainless steel or coated with food approved plastic, paint or beeswax. Containers should not allow any odor to reach the honey. Honey readily absorbs odors of all kinds.

4.2.5 Main Exporters:

According to the information from the Ministry of Trade and Industry and the Ethiopian Meat and Dairy Industry Development Institute, honey is exported by different business organization to different countries.

Table 17: Ethiopian honey exporters; source: Ethiopian Horticulture Producer Exporters Association (EHPEA)

S/No.	List of Exporters	Export volume in metric tons per year		
		2017/18; 9th residual national monitoring plan	2018/19; 10th residual national monitoring plan	2019/20; 11th residual national monitoring plan
1	Beza Mar Agro-Industry PLC	230 .0	120.0	100.0
2	South Region Farmers Cooperation Federation	140.0	100.0	120.0
3	Zembaba Bees Product Development and Marketing Cooperation Union	100.0	----	----
4	Apinec- Agro-Industry PLC	100.0	80	80.0
5	Tutu and her Family Commercial PLC	100.0	30	80.0
6	Sheka-Nordic and Beeswax Development Industry	80.0	70	----
7	Dimma Mar Processing and Beekeeping Development PLC	80.0	60.0	100.0
8	Ali and Mohamed PLC	80.0	----	----
9	Comel PLC	80 .0	65.0	80.0
10	Kafa bees-product Development and Marketing Cooperation	60 .0	35.0	----
11	Yerkisho Honey and Beeswax Trading PLC	60.0	10.0	20.0
12	Limu Coffee Agricultural Development	60 .0	6.0	2.0
13	Sheka bees-product Development and Marketing Cooperation	50.0	---	----
14	Babich PLC	36.0	60	40.0
15	Yosef and Elisabet PLC	20.0	---	---
16	Etenesh Getachew PLC	1.0	----	----

17	Humpty PLC	1.0	19	5.0
18	Green forest Honey exporter	---	17.0	----
19	Zembaba Coopertives	----	15.0	---
20	Emebet Commercial	---	10.0	1.0
21	Micheal Honey export	---	10.0	----
22	Bebeka Coffee SC			2.0

4.2.6 Main importers: The major destination countries for Ethiopian honey are Norway, Sudan, Germany, Qatar, the United States of America, Yemen, the United Kingdom, Saudi Arabia, Japan, France, and other countries in smaller volumes.

Table18: Ethiopian honey export volume by countries from 2016/17 to 2019/20; source Ministry of Trade & Industry

Year	Sudan	Yemen	United States	Qatar	Norway	France	Japan	German	Saudi Arabia	United Kingdom	Other countries
	Honey /kg	Honey /kg	Honey /kg	Honey/kg	Honey /kg	Honey /kg	Honey /kg	Honey /kg	Honey /kg	Honey /kg	Honey /kg
2019/20	37,572	2,630	3,200	300	110,174	---	1,190	120,005	141	224	2,665
2018/19	21,200	1,250	730	------	82,800	----	680	------	----	20,890	7,893
2017/18	75,360	3,000	22,380	----	59,820	----	3,770	82,550	----	----	69,100
2016/17	82,540	1,640	930	50	120,150	62,740	4,100	20,960	3,190	73,080	74,730

According to the Central Statistical Agency of Ethiopia, major export destination countries for Ethiopian beeswax are Germany, the United States of America, Japan, China and other countries in smaller volumes.

Table19: Ethiopian beeswax export volume by countries from 2016/17 to 2019/20; source Ministry of Trade & Industry

Year	United States of America	Japan	China	German	United Kingdom	Other countries
	Wax/kg	Wax /kg	Wax /kg	Wax /kg	Wax /kg	Wax /kg
2019/20	52,500	59,000	53,000	------	-----	----
2018/19	87,520	23,000	52,000	120.650	87,520	------
2017/18	106,000	53,000	-----	176,000	---	25,700
2016/17	88,000	70,000	-----	122,340	12,000	10,000

4.3 Analysis of challenges and constraints in value chain development:

In the value chain, wax is produced from three sources: the first source is from combs bits of brace comb gleaned from hive during manipulation; the second source is from capping [35], at the time of honey extracting or processing; and the third source is from the residual of tej which constitutes the biggest source, but which is mostly wasted and because of the unnecessary wastage of bee wax produced in the preparation of tej, the country does not export the expected wax volumes, which is in high demand in international markets.

The beehives boxes, colonies and processing equipment are expensive compared to the financial capacity of the actors. The honey value chain is not linked with the national quality infrastructure to verify the compliance of the requirements at each stage. Beside this, the sector is not supported by technical regulation.

4.4 Analysis of challenges and constraints in quality compliance: To maintain bee products, the supplier is expected to establish bee product collection, purification and storage site which meets the stipulated criteria developed by the standard agency or importing countries ensure by competent / accredited conformity assessment bodies. However, the regulation system is not established to implement and verify the requirements of bee product during harvesting, collection, transporting and processing by the appropriate bodies.

There is also problems on unavailability of technical regulation so far indorsed in the country to be followed by the actors; no inspection at each value chain, low production /productivity and quality, low adoption of improved beekeeping technology, high prices and low quality of improved beekeeping equipment, weak extension services, large scale application of various agro-chemicals and pesticides, apid degradation of natural resources, absence of adoption of suitable colony multiplication techniques, there is no accredited testing laboratory that can test the chemical pesticide and herbicide residual characters in honey. There is no area code for honey that indicates the source of the product which is useful to trace back when it requires knowing its origin.

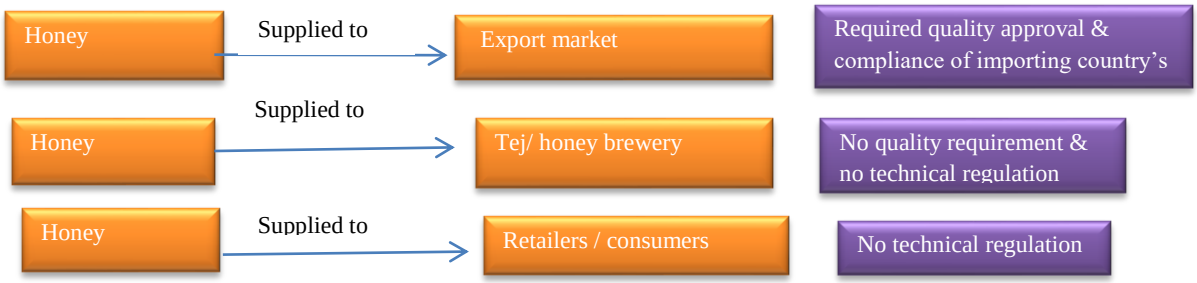
Because of adulteration, many consumers are afraid of using honey for consumption by buying from unknown retailors. There are no mobile testing laboratories to conduct simple tests like adulteration, moisture, acidity, ash content and other simple tests at the site where collection and selling of honey carried out. Labeling is not mandatory especially in the local market so many buyers possibly can open the container and have a look its quality without realizing the impact of contaminant risk of the product to micro-organisms (bacteria, yeasts and moulds).

4.5 Mapping of the demand for quality infrastructure services:

Since the product, honey, is not under technical regulation, there is no concerned body that can develop requirements, guidelines, and directives to serve the sector and to be followed and implemented by the collectors, processor and retailers. Because of this, there is no mandatory inspection along the value chain that supports the

correction of quality failures on time, or to use the inspection finding as input for improvement. When collectors, processors and retailers want to check the quality of their products, there is no testing service facility at close distance to provide conformity assessment services. In Ethiopia, honey is classified neither under any mandatory product certification nor under food safety management system that requires conformation of quality compliance to be presented as evidence to regulatory Bodies. Honey that has been produced at different areas has its own particular taste and price. For example, Rira honey produced in Rira village, Oromia has a creamy texture and a pale hazelnut color, the flavor is intense and fruity, with notes of malt and caramel; Tigray white honey has an uneven, granular texture, good consistency, and a beautiful bright white color, the aroma is delicate, while the flavor is mildly sweet with an intense, lingering aftertaste [36]. , However, the honey is collected in one container; the high in demand and expensive honey is mixed with cheap honey by collectors, retailor and processors and is sold under the pretense of being the high in demand honey; a practice which contributes to the growth of fraudulent behavior among value chain actors.

Figure 6: alternatives honey supply chain and quality control



This shows, the majority of honey products which are absorbed by the local market does not require or enforce compliance with any standards, hence, the cultural honey supply practice that has been exercised and still being exercised becomes a hindrance to building a quality culture by the actors.

5 In-depth analysis of the National Quality Infrastructure for the honey VC

5.1 The Ethiopian Standard Agency, ESA: is the only standardization body in the country and is responsible for developing and issuing national standards. The Agency has been established by Council of Ministers Regulation Number 193 /2010 with a mandate to lead and coordinate the national standardization; confirm and publish the

national Ethiopian Standards; promote the implementation of standards; promote Ethiopian Standard Mark and authorize its use; represent Ethiopia in the International Standards Organization and work in collaboration with other foreign national standard bodies; establish a National Enquiry Point; and deliver services on Standardization, Conformity Assessment Guidelines and Technical Regulations development that enable Ethiopian industries to benefit from technology transfer by providing technical support, training, and consultancy to implement standards.

The development of standards takes place through technical committees (TCs) composed of stakeholders from within the discipline. Standards development is an expensive and time-consuming process because it requires needs assessment, interviews, scientific research works and consultations with various stakeholders to reach consensus.

ESA is a member of ISO, IEC and Codex Alimentarius Commission and participates in 104 ISO/IEC TCs (47 as participating member and 57 as observing member).

The Ethiopian Standard Agency has developed Food and Agriculture - Honey-Specification (ES 1202:2015) as well as Food and Agriculture - Beeswax-Specification (ES 1203:2015). But the standards are neither mandatory nor referred to in regulation. The local beverage, tej has no approved developed standard; no requirement along the value chain and no compliance verification or inspection checklists; and there is neither a developed nor adopted good manufacturing practice for honey production that can serve for improving the production, collection and processing of honey.

Standards and Technical Regulations: Based on ISO and IEC recommended practices for standardization by national bodies, (ISO/IEC Guide 59:2019), ESA has developed a guiding document called standard for standard development to be followed while technical committees are developing standards. Currently, more than 400 organizations are members of national technical committees, with 30 % from Government and 70 % from industry and associations.

ESA has selection criteria for technical committee members developing national standards. These are sufficient knowledge and understanding on the matter, fair representation of interested parties affected by the standard, that can be an individual or collective representation, depending on the size of interested parties, observers are

allowed on request to observe, technical committee membership nomination is the right of ESA and cannot be claimed and appealed on the basis of it being a right to become a member.

ESA has developed and adopted around 10,871 standards and out of this 5200 are requirements and specifications, 5418 are test methods, procedures and sampling and the rest are guide lines, codes of practice, standards, terms and definitions. 253 standards are Technical Regulations / mandatory standards. However, there is no evidence or data that indicates the status of the standard implementation, but there is a study survey on going to review the current status of standard implementation. Currently, there are 253 Technical Regulations and out of these, only five have regulatory schemes. The remaining 198 Technical Regulations are without schemes.

The Ethiopian Standard Agency, ESA has the primary responsibility to oversee the development of national standards and to publish them. Since training and consultation for the implementation of standards is the mandate of the agency and necessary for the realization of its mandate, recently, the agency has built a training centre and which is expected to become operational soon.

The national technical regulation for products and services are developed by the Ethiopian Standards Agency but, the request shall come from regulatory. The technical regulation is administered by the regulatory, the quality mark is administered by ESA, and the conformity assessment is delegated to the Ethiopian Conformity Assessment Enterprise (ECAE).

5.2 Metrology: The National Metrology Institute of Ethiopia has been established by the Council of Ministers Regulation No. 194 /2010 and was operationalized on 10th February 2011. The institute is responsible for the maintenance of Ethiopian National Measurement Standards; keeping the traceability of measuring scientific equipment and Certified Reference Materials (CRM); providing calibration, training and consultancy services in the area of metrology; and providing services on scientific equipment maintenance and scientific measuring requirements.

NMIE is providing calibration services in the following metrological fields: Length measuring instruments, standard masses, weighing instruments, temperature measuring instruments, pressure measuring instruments, force measuring instruments, volume measuring instruments, density measuring instruments, electrical measuring instruments and ionization radiation measuring instruments.

The institution has been accredited for the majority of its calibration services: Mechanical (mass, weighing instruments and pressure); chemical analysis (volume of liquids); electrical (DC voltage, DC current, DC resistance, AC voltage, AC current) under thermodynamic quantity, temperature (resistance thermometers, thermocouples, liquid-in glass thermometers, direct reading thermometers, mechanical thermometers) by the national accreditation body for the Federal Republic of Germany DAKKS; it has proper documentation; and has built a system as per ISO/IEC 17025. Since January 2018, NMIE is an associate member of BIPM, a member of AFRIMETS and member of the North East and West Africa sub-regional metrology organization, NEWMET.

5.3 Testing and Calibration: There are private government testing and calibration service providers.

5.3.1 Calibration:

1. Metro Alliance Calibration and Verification Services provides calibration on mass using class M1 within the range 1g to 2 kg; temperature using digital thermometer, PRC 20 thermocouple calibrator type within the range -50 to 1370 ^{0}C; pressure using hand operated pressure pump Additel 925 within the range 12.5 psi (0.85 bar) vacuum to 6,000 psi (400 bar). The traceability is maintained through NMI that has high measuring accuracy compare to the calibration laboratory. The calibration service provided by Metro Alliance is not accredited by any accreditation body; hence, its service has no international acceptance.

2. The Technology and Innovation Institution which is a Government institute that has been restructured recently to include the calibration laboratories owned by METEC, the "Quality Engineering Center" that was providing calibration and testing services largely to the Government and in a limited manner to private organizations, and also supported the sector with research and development activities as follows:

Balances for mass calibration: The laboratory has owned different balances in the range from 0.1 g to 64 kg for calibration range of different mass from 1 mg to 60 kg.

Pressure: There is different piston pressure calibration equipment with gas media from -100 to 7000 KPa and oil media for high ranges from 0.04 to 250 Mpa, very wide range to provide wider range services than the NMIE.

Temperature: There are different temperature calibration equipment from cryogenic liquid, ice point to highest calibration equipment furnaces and thermocouples up to

1500 0c. the major equipment include cryogenic liquid thermostatic bath , thermostatic bath dry block calibrator, water bath, oil bath, medium furnace temperature, high furnace temperature, platinum digital thermometer and several different thermometers.

Electricity: There are different equipment for electricity calibration laboratories including, Multi-Function Calibrator (require maintenance and calibration), Digital Multi Meters, DC Standard, and Resistance Standards.

The metrological traceability is maintained by the National Metrology Institute of Ethiopia.

3. Winner Engineering PLC is providing mass calibration service for class F1 & F2, 1 mg to 2 kg, and OIML class F2 served for 5kg, 10 kg, 20 kg and class M1 served for 50 kg and 100 kg, class F1 to M3 in support of the legal metrology practices for the last ten years and reachable in different regions of the country. The traceability is maintained through NMI. Winner Engineering PLC service is not accredited.

4. Tigray Bureau of Science and Technology is also providing mass calibration services for class F1 for 1mg to 20kg, class F2 for the range 1mg to 20kg and class M for the range 5kg to 20kg. The organization does not provide accredited calibration services. The traceability is maintained by NMIE. Since the location is closer to honey farm areas compared to the other service providers mentioned above, it is important to extend the service on electrical, temperature, pressure, volume, balance and speed (rpm) calibration.

The calibration scopes required for honey across the value chain are mass, balance, volume, electrical, temperature, speed (rpm), humidity and photometry. The humidity and photometry are calibrated using certified reference materials (CRM); except speed, all other measuring units are calibrated locally with the traceability to the primary measuring unit by NMIE but the speed (rpm) is calibrated outside the country.

Measurements of retailors, collectors and exporters are regulated by the Ministry of Trade and Industry Department of Legal Metrology, which regulates the appropriateness of measuring instruments, packaging and food items by inspecting and/or verifying their compliance with the stipulated requirements.

5.3.2 Testing: There are 39 testing parameters to be tested by laboratories for honey and out of these testing parameters, 27 parameters are chemical, 2 parameters are physical and 10 parameters are environmental. The conformity assessment test request mostly comes from honey exporters because it is a requirement by the regulatory authorities of the importing countries and buyers. The commercial conformity assessment testing services for honey are located in Addis Ababa; ECAE, Bless and JIJE are located in Addis Ababa; that means, there is no conformity testing providers at or near harvesting and collection sites. However, there are laboratories which are non-commercial, with limited capacity in terms of equipment, chemical and human capability; laboratories like Holeta Research Centre, Ethiopian Meat and Dairy Industry Development Institute and under Tigray Soil Research Center, Honey Research Laboratory Department. The three conformity assessment testing laboratories found in Addis Ababa ECAE, Bless and JIJI are covered by the World Bank project support, whereas those, which are outside of Addis Ababa, have not received attention by the World Bank project.

Note: The national quality infrastructure development project supports to strengthening institutional capacity for NQI development and to enhancing private sector engagement at the textile, leather and agro processing economic sectors that has been identifies as an export potential of the country.

The Ethiopian Conformity Assessment Enterprise has got FT-IR equipment from the World Bank project for residual analysis; there are also atomic absorption and Microwave Plasma Atomic Emission Spectrometry (MP-AES) and Inductively Coupled Plasma Mass Spectrometry (ICP-MS) analysers that enable ECAE to test heavy metals.

Bless Agro Foods Laboratory Services PLC has Gas Chromatography Mass Spectrometry (GS_MS) for residual test and Atomic Absorption Spectroscopy (AAS) for heavy metal test.

JIJE Analytical Testing Service Laboratory has also analytical equipment that enables testing for residual chemicals and heavy element in food.

Mekelle and Holeta honey test laboratories need to be re-equipped and capacitated to enable them to provide testing services across the value chain closer to the honey production sites.

5.4 Certification: In the food industry, there are two kinds of certifications, product certification and management system certification. According to the survey conducted under the World Bank project, most of the importing countries require honey organic certification as well as quality management certification. The certifications are provided by eight certification bodies; ECAE, SGS, DQS, Bureau Veritas, Ceres, Control Union, BCS and Ecocert.

In Ethiopia, there is no mandatory management system certification, and no one is controlling / administering the reliability of management system certificates provided by certification bodies. Since honey is a food item, producers are expected to apply and comply with food safety management system standards, and / or product certification or/ and Good Manufacturing Practice (GMP) for honey.

The Ethiopian Food and Drug Authority accepts GMP certificates for pharmaceutical products but has not yet developed and applied suitable GMP for/to food / honey. Conformity assessment bodies operating on system certification in Ethiopia are ECAE, ISOQR, DQS, and Bureau Veritas, and, out of these, ECAE is accredited by ENAO for quality management system certification, whereas others are operated by agents or disk representatives or correspondent that facilitates connecting the applicant with the main office of the certification body situated and operating outside Ethiopia

5.5 Inspection: In Ethiopia there are three Government ministries responsible for regulatory inspection of food products:

- The Ministry of Agriculture inspects the production process of honey,
- The Ministry of Health through the Ethiopian Food and Drug Administration Authority inspects imported honey, and
- The Ministry of Trade and Industry Department of Legal Metrology inspects consumable items and pre-packaging. Within the Ministry, the Department of Market and Factory Inspection inspects food items to ensure that the processed food products consistently comply with the applicable requirements before they are being delivered to the market. This can take the form of inspecting food processing factories from input to output of the products to ensure compliance of the product as well as market inspection to protect customers from any expiry / unstable, adulterated and counterfeit products. However, it is not effectively implemented for honey.

The Ministry of Trade and Industry accepts SGS and ECAE inspection results. So far, there is no inspection service provider which covers the entire honey value chain.

5.6 Accreditation: Accreditation services are provided by the Ethiopian National Accreditation Office (ENAO) that has been established as the sole third party accreditation body to verify or attest the competence of conformity assessment bodies. ENAO was established at the end of 2010 by regulation number 195/2010; because of inconsistency with the international practice, the regulation was reorganized and re-established by regulation number 279/2012; and again reviewed and reorganized for the second time in 2017 to include the mandate of provision of training on accreditation standards and re-established by regulation No. 410/2017.

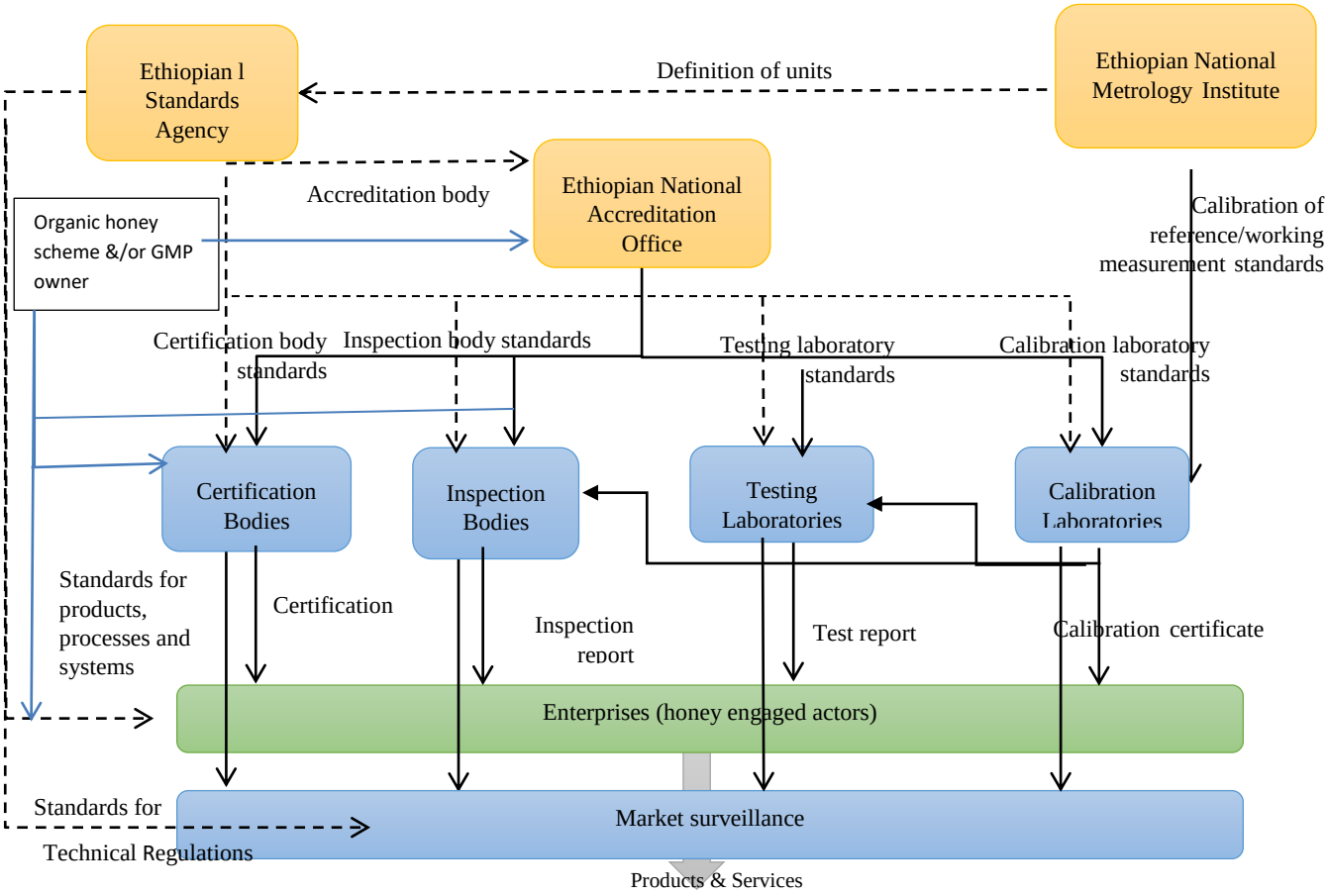
Since 2017, ENAO has been a full member of ILAC and a signatory to ILAC- MRA for testing (ISO/IEC 17025), Medical Testing (ISO15189) and Inspection (ISO17020). ENAO has adopted the IAF Code of Conduct in September 2016. As the market of calibration and certification is very small, ENAO is challenged to extend its ILAC-MRA scopes for calibration, PT providers, as well as CRM producers. Because of the limited number of certification bodies, ENAO could not get market to accredit certification bodies hence, ENAO's accreditation service for certification providers is not internationally recognized. However, the World Bank project is providing consultation support to potential conformity assessment bodies to board the certification bodies for accreditation. And also ENAO has applied to AFRAC for MRA scope extension on calibration and management system certification, sub scope quality management system certification.

The conformity assessment service providers engaged in testing and inspection of honey can get internationally accepted accreditation services at low cost and closer distance from ENAO.

5.7 Private standards and initiatives: There are no private standard developers in Ethiopia. However, if there is a need, a request can be submitted to the Ethiopian Standards Agency to develop the standard through the relevant Technical Committee. Currently, by the initiation of the Ministry of Agriculture, a honey scheme is being developed. In general, there is no delegation practice for the development of sector-specific standards by any organization (private or Government), and no system put in place by the Agency that encourages the developing of private standards.

5.8 Mapping of the supply of quality infrastructure services:

Figure 7: Ethiopian National Quality Infrastructure



5.9 Identification of gaps of quality infrastructure services to be bridged

The concept of technical regulation is to limit the contamination of honey through vegetable and manual feeding of bees with artificial sugar that constitute a hazard to health. But honey adulteration is happening by adding inexpensive sweeteners commonly sugar syrup, maize and/or wheat flour syrup, banana and sweet potato. There is no technical regulation for honey in Ethiopia, only the voluntary standard has been developed which the implementation is not exercised. Therefore, as a country, it requires technical regulation that includes: hygiene practices in honey production, beekeeping practices, honey quality parameters; sucrose content, water insoluble solids, mineral content, acidity, diastase activity, hydroxymethylfurfural content, moisture content, food-grade packaging specifications and storage and transportation guidelines

- Ethiopia has no technical regulations for honey and the standard: ES 1202:2015 of ESA is currently on the process of converting to technical regulation and the agency

is working with the Ethiopian Honey and Beeswax Producers and Exporters Association (EHBPEA),

- there is no close quality infrastructure service across the value chain. The service is concentrate at the centre of the capital city, Addis Ababa,
- there is no GMP developed as per to the context of the country,
- the standard requirements of organic honey are communicated to none of producers, collectors and retailers, conformity assessment bodies and the accreditation body,
- lack of access to PT services, and it hinders the conformity assessment testing to accredit their services where they are required to participate in inter-laboratory comparisons. In Ethiopia, currently, have no PT provider and CRM producer,
- according to the World Bank project survey, the cost of conformity is expensive compare to the financial strength of enterprises hence, the enterprises are not motivated to check the compliance of their products and service by conformity assessment bodies,
- currently NMI is not maintaining the traceability of speed (rpm) measuring instrument, hence the labs and processors are calibrating outside which costs them high,
- no accredited inspection service provider across the value chain of honey,
- since the testing laboratories of ECAE, JIJI and Bless for residual and heavy metal parameters are not accredited, the exporters enforced to send samples of their processed honey to Germany and other countries for quality testing assurance. During this process, they face challenges in getting foreign currency and also inconvenience for sending samples to overseas. As a solution, World Bank project is supporting the three labs to accredit their residual and heavy metal testing services.

6 Business Support Institutions and Schemes

6.1 Regulatory authorities: In Ethiopia, there are three government ministries responsible for regulatory inspection of food products.

A) Under the previous Ministry of Livestock and Fisheries Resource which is now imbedded within the Minister of Agriculture, there is Apiculture Resource Development and Protection as a regulatory established by Council of Ministers Regulation No. 372/2016. The regulation outlines any beekeeper engaged in one or more modern (not traditional) honeybee colony development required to register and

mark or put an identification number to the honeybee colony, and the beekeeper are mandated to put the certificate at conspicuous place that is visible to the apiculture resource development inspectors. The proclamation also outlines how the apiary site ought to be determined; requirements on honey bee products and beekeeping equipment; competency requirements for an interested researcher to engage in honeybee, beekeeping equipment and honeybee products; processing, packaging, handling, labeling and transporting; apiculture resources; honey plant protection; the requirements for those engaged at commercial queen bee rearing; obligation of beekeeper and certificate of competence by the regulatory to those engaged in the production; powers and duties of the supervision authority and the apiculture resource development inspection.

Recently, the Ministry of Agriculture developed a draft proclamation document entitled "Bee Product and Colony Marketing Proclamation No. --/20xx" and has submitted it to the Council of Ministers for review and approval.

B) The Ministry of Health is responsible for food inspection through the Ethiopian Food and Drug Authority, to which authorization was given by Food and Medicine Administration Proclamation No. 1112//2019. The proclamation applies to food and tobacco products, alcoholic drinks, medicines and medical devices. Since honey is under the category of food, the requirements stated to apply to food also apply to honey.

In the proclamation a mandate was given to regulate labeling, packaging, advertisement, promotion and prohibitions that shall be followed. They are:

1. Any product regulated under the proclamation:

a) shall be appropriately packed and display labeling on its primary packaging;

b) its packaging material shall not contaminate the product and comply with standards issued by the appropriate body; and

c) its labeling shall not be misleading and not contain information that is inaccurate.

2. The primary packaging of a packed food shall have a label in Amharic or in the English language. The executive organ may by a directive determine labeling requirements different from Amharic or the English language, or lebaling attached else where

The proclamation clause 54, food packaging and labeling, has requirement for the enforcement to be fulfilled without prejudice to general labeling provisions like :

a) Fortified food labeling shall contain a description of the type of micronutrient used to enrich the food;

b) Labeling, description, or advertisement of any food supplement shall not give the appearance to be intended for use in disease prevention, treatment, or cure, or in any way characterized as a medicine;

c) A food containing genetically modified elements may only be placed on the market if it is packaged and its label contains the phrase “genetically modified”, “genetically modified organism” or another comparable description.

d) Labeling of irradiated food shall contain the phrase “irradiated” or the internationally accepted radura symbol, indicating that a food product has been irradiated with ionizing radiation, may be placed besides the labeling.

e) If the food product contains milk and milk products, fish and shellfish, wheat, barley, peanuts, soybeans, and other food allergens its labeling shall clearly describe its content.

Under sub-clause 62, which explains about prohibited actions, are:

1/ the doing of any act which causes a regulated product to be adulterated, misbranded, counterfeited, and sub-standard;

2/ poisoning a food by mixing any substance that is deleterious to human health;

3/ the trading of or provision to the public of any adulterated, sub-standard, misbranded, and counterfeited product;

4/ the receipt to trade of a regulated product that is adulterated, sub-standard, misbranded, counterfeited, and the delivery or proffered delivery thereof for pay or otherwise;

5/ the refusal or obstruction of inspection and related activities as authorized under this proclamation;

6/ the mobile sale of medicines and medical devices; and

7/ conducting trade in regulated products in contravention to regulations, directives or other laws issued to implement this proclamation.

As per to the information obtained from Mr. Betre, Director of Food Inspection Department at Ethiopian Food and Drug Authority, the regulation is not practically applied for honey because of low attention given to the sector.

C). The Ministry of Trade and Industry is also issuing regulations on food items, especially as part of legal metrology for consumable items and pre-packaging, but there is no clear regulation that applies to honey and honey products and the activity in its regulation is not effective for honey and honey products; there are also an import and export inspection and factory and market surveillance inspection directorates, however, their regulation activities are not instrumental for honey and honey product processors. The Ethiopian Meat and Dairy Industry Development Institution has also submitted a document to the Ministry of Trade and Industry for its review and submission to the Prime Minster's Office for approval and to be published with the Council of Ministers' regulation to support the development of honey processing. In parallel to the regulation, a ten (10) years strategy has been developed and submitted to the Minister of Trade and Industry for approval after review.

Under the Ministry of Trade and Industry there is also a regulatory body, the Trade Competition and Consumer Protection Authority, established by proclamation No. 813/2013. One of the objectives given in the proclamation is to ensure that consumers get goods and services which are safe and suitable to their health and proportionate to the price they pay. However, the practice of the daily operation of the organization is gravitating towards price regulation, service warranty and reporting on the deficit of demand over supply in the marke, but. not procedure and policy development in regards to quality requirements for the regulated products that can affect the health of consumers.

To transform and satisfy quality and quantity demand by consumers for honey and honey products, Ethiopian Agricultural Transformation Agency (ATA) signed a Memorandum of Understanding (MoU) to partner with the Ministry of Trade and Industry (MoTI) to support selected public and private enterprises to establish and upgrade Quality Testing Laboratories for honey. The CEO of ATA, Khalid Bomba and State Minister for MoTI, Ato Eshete Asfaw, signed the MoU. The agreement expects to provide a partnership framework among ATA and MoTI to provide financial and technical support to selected private and public enterprises to establish and upgrade internationally accredited quality testing laboratories for honey [37].

6.2 Export standards and quality control authorities: Since honey is consumed by people irrespective of age, its quality needs to be ensured so as to not negatively affect the health of consumers. Under the Ministry of Agriculture, the

Apiculture Resource Development and Protection regulatory body in collaboration with the Ethiopian Standards Agency are developing honey and beeswax schemes. Currently, there exist the Food and Agriculture - Honey-Specification (ES 1202:2015) and the Food and Agriculture - Beeswax- Specification (ES 1203:2015) standards, but they are not mandatory standards. In the scheme and technical regulation development, the way it develops should not follow the normal procedure of standard development; it should accommodate the technical regulation of importing countries.

6.3 Quality extension services: A unique feature of Ethiopia's agriculture sector is that it has received unprecedented high-level political commitment since the current government assumed power in 1991. The Agriculture Development-Led Industrialization (ADLI) strategy was developed in the mid-1990s to serve as a roadmap to transform smallholder agriculture. Rural education, health, infrastructure, agricultural research, and AES were among its top priorities. Ethiopia is one of only four African countries to have implemented the Comprehensive Africa Agriculture Development Programme (CAADP) agreement of a 10 percent target of annual government expenditures earmarked for agriculture over the 2003–2013 periods [39]. More recently, Ethiopia's transformation agenda elaborates its ambitious on the second five-year Growth and Transformation Plan (GTP), placing significant importance on the agriculture sector in general, and on the Agricultural extension service (AES) system in particular [45] .

Agriculture extension services (AES) are critical for promoting the adoption of improved farm technologies to increase productivity. Ethiopia has heavily invested in its agriculture sector in recent years, including in its massive public agricultural extension system, which is the largest in Africa. Ethiopia has also registered substantial economic progress in recent years, largely attributable to agriculture growth [45]. So far there is no specific quality extension service for honey available at farming sites. Quality extension services for honey will need to learn good practices from other countries to be shared with Ethiopian honey producers.

6.4 Sector associations: As per the information gathered from The Ethiopian Meat and Dairy Industry Development Institution, there are more than 17 organizations operating within honey processing and export activities (refer to table 6). There are many unions and cooperatives engaged in the honey value chain. However, there is no clear data available on the number and capacity of the unions

and cooperatives engaged in honey-related activities at the national level. But, there is an incomplete list of unions and cooperatives that has been operating in the honey value chain from the Ethiopian Honey and Beeswax Producers and Exporters Association (EHBPEA); those are: Melese union, Bokra union, Meaza union, Zenbaba Beekeepers Union, South Region Farmers' Cooperative, Agunta bee products cooperative, Tsedey bee products cooperative, Abmbasel bee products cooperative, and Andinet Honeu products Cooperative, Majang Farmers Union, Bench Maji Union, Keffa and Masha Union, Aba Bora's Becho and Didu Woreda union. To trace the origin or source of the honey in the market, a traceability chain will need to be established by structuring the chain flow by creating a link among beekeepers, organizations, cooperatives, unions and exporters.

6.5 Main trade fairs at national, regional, and international level: Participation in trade fairs will help to introduce the products and create market linkages with other interested bodies. Therefore, participation of the Ethiopian honey producers, processors and exporters in trade fairs will enhance their market opportunity, quality based competition and sharing of experience. However, the costs associated to participate at trade fair / expo like participation fee, transport / flight cost, accommodation and cargo fee seems unaffordable to Ethiopians . The honey trade fair is not facilitated at national level by honey actors, rather, they participate when there are food trade fairs and this diminishes their chances to be seen by interested visitors; at international and regional trade fairs, the Ethiopian honey actors the exporters, producers and processers find themselves where honey trade fairs / expo exists. As to the feedback given by Emebet Commercial Beekeeping for Environment Plc, the trade fair displaying area and other associated costs are expensive and this has become a barrier to participating in the regional and international trade fairs.

Based on a request to Ethiopian honey producers, processers and exporters regarding their trade fair participation, e.g. if they did for the last five years, solicited via email, three companies responded:

Table 20: Trade fair participation since 2014. Source: declared by the companies				
S.No.	Organizations which participated in the trade fair	Title	Place of trade fair	Year participated
1.	Comel Plc.	Third International Honey Exhibition	Doha / Qatar	Jan 2020
		Second International Honey Exhibition	Doha / Qatar	Feb / 2019
		Gulfood Manufacturing 2017	Dubai / UAE	Feb 2017
		BioFach America	Baltimore / USA	Sep 2015
		BioFach 2015	Nurnburg / Germany	Feb 2015
		Gulfood 2014	Dubai / UAE	Feb 2014
		BioFach 2015	Nurnburg / Germany	Feb 2014
2	Emebet Commercial Beekeeping for Environment Plc.	Twende	Nairobi	Nov. 2019
		SIAM	Morocco	April 2019
		Gulf Food	Dubai / UAE	Feb 2017
		Biofach	Germany	Feb 2015
3	Golla Bee Products Plc	Apimondia 2019	Montreal / Canada	In 2019
		Apimondia 2015	Daejeon/ Korea	In 2015

Most of the exporters have a desire to participate in the international and regional trade fairs, but because of financial limitations, the companies could not participate as to level of their interest.

6.6 Traceability: Apiculture Resource Development and Protection that had been established by the Council of Ministers Regulation No. 372/2016 seeks to develop a system of traceability, because any beekeeper engaged in modern honeybee colony development is required to register and have the registration certificate with a specific registration mark for each honeybee colony. However, the regulation has not gone beyond paper, not not been implemented, no structure and system at regional levels exist that help to execute the regulation, hence, there is no traceability that can trace the originality of the honey offered in the market.

7 Other Aspects

7.1 Environmental Impacts: The honey sector is environmental friendly. Because bees are sensitive to pesticides and other contaminants, beekeepers use virtually no chemicals and take great care to use chemical-free materials for the hives and frames. The sector thus promotes the principles of organic agriculture and sustainable practices. In order to encourage sustainable, bee-friendly agriculture with less use of chemical pesticides, MAA is seeking cooperation and interaction with agricultural producers. Finally, there is a positive correlation between apiculture and agriculture and horticulture production because of the role of bees as pollinizers of plants.

7.2 Women and youth in the value chain: Particularly women and landless youths are engaged to boost honey production and expand the market base by improving access to key inputs, finance and market. The government has a commitment and provided attention in improving the technical, business and entrepreneurial skills of small producers and other value chain actors and supporters in collaboration with cooperative partners; because of this, women's skill and knowledge based engagement in beekeeping is growing from time to time, and this ultimately supports to increase the volume of honey produced in the country [3]. However, still it needs strong support from cooperative partners to engage more women and youth in the sector and provide more technical support to make them competitive by producing quantity and quality honey; besides this, a system is required that has to be developed to assess the number of women and youth participating in the sector.

7.3 Production techniques and skills development: Even though all universities are open for graduates and undergraduates to conduct research or write a thesis to comply with requirements for their graduation, the research theme selection is not based on the Government and beekeepers needs and, because of this, the research outcomes are not well communicated to the honey beekeepers.

The organizations which support the productivity and quality production of honey are:

1. **Oromia Agricultural Research Institute (IQQO), Holeta Bee Research Center** which is a honey research center mandated to conduct research in apiculture for the region as well as the country for solving the problems of honey production,

which is found in the Special Zone of Oromia around Finfin, 37 km west of Addis Ababa. The research focuses on five areas:

- honey bee products postharvest handling, processing and quality control
- Beekeeping management and genetic improvement, which includes colony multiplication and management for better productivity
- Bee botany (bee forage and pollination ecology)
- Bee health/protection
- Honeybee equipment engineering.

2 Ethiopian Meat and Dairy Industry Development Institute (EMDIDI) which has been established with the main objectives of meat and dairy sector development and competitiveness of the sector in the global arena by the Council of Ministers Regulation No. 295/2013. However, as per to the information obtained from Director General of the Institution Mr Haileslase Wores, the institution is in the process of revising its regulation to include honey development and competitiveness in its mandate.

7.4 National and international development cooperation programmes and projects: There are international cooperation partners working to support the Government and private sector to assist to make the country's agricultural products to be competitive in the international markets and the African Continental Free Trade Area. To mention some of the cooperation partners supporting the increase in productivity and quality of honey are:

1. The Schweizerische Normen-Vereinigung *(*SNV), which is similar to the Swiss Association for Standardization, which supports business organizations and their access to markets (BOAM) by developing strategic intervention plans for the honey and beeswax value chain by multi-stakeholder engagement to the value chain development in Ethiopia.

2. International Finance Corporation (IFC) is supporting the apiculture value chain for the possibilities to open an opportunity for farmers to use agricultural commodities as collateral for their financial need.

3. Advance Technology Attachment (ATA) and National Quality Infrastructure Development Project (NQIDP) support to honey quality testing labs in Ethiopia.

4. The Agence Française de Développement (French Development Agency - AFD) support for geographical indication registration scheme.
5. National Quality Infrastructure development project (NQIDP) funded by the World Bank soft loan to supporting specifically the quality infrastructure services to the agro-processing, leather and textile sectors.
6. Physikalisch-Technische Bundesanstalt *(*PTB*)* is providing support to improve the honey value chain in Amhara region and some part of Oromia.
7. Advance Technology Attachment (ATA) has agreed with the Ministry of Trade and Industry to support the technical regulation of honey and honey products.

8 Recommendations for the project implementation

8.1 Enhance technical competence and sustainability of the national quality infrastructure system: Among the quality Infrastructure units, ESA, NMI and ENAO have regional and international linkages and their participation and their membership status is not at the stage of excellent but not bad. The standards developed and adopted by the Ethiopian Standard Agency are not implemented to the level of national expectation; engagement and participation in the international and regional technical working group and committees is very low and the inquiry point for WTO accession related to the TBT Agreement is not active. The National Metrology Institution of Ethiopia is not a full member of BIPM, however, majority of its calibration services are accredited by DAAKS which is an ILAC-MRA signatory. The chemical metrology service has not yet started; the calibration service rendering for measuring instrument is not covering the whole scope requested from conformity assessment bodies and, because of this, conformity assessment bodies are forced to calibrate their measuring devices abroad. The Ethiopian National Accreditation Office is not a IAF-MLA signatory, however, application for scope extension in calibration and management system certification has been submitted to AFRAC for evaluation; capacity development on proficiency testing for providers (ISO/IEC 17043), certified reference material producers (ISO/IEC 17034), product certification (ISO/IEC 17065) and certification for persons (ISO/IEC17024) is needed. However, support is provided by the World Bank project through a twining arrangement with the Quality Council of India to fill the existing gaps.

Even though the quality institutions / organizations are supported by the World Bank project, the support focuses on the end product, and is not aimed at linking the whole

value chain. For example, the Ethiopian Conformity Assessment Enterprise is supported to test residual chemicals and the test result of the laboratory supports either to reject or accept the product, it does not support the improvement of the product. Rejection of the final product, after passing many steps in the value chain, highly affects the producers. Therefore, there shall be activities in each step of the value chain to minimize the rejection volume and correct the problem on time, which might be achieved by using optimal amount of pest and herb sides so that the residual will be at the acceptable level. In general the World Bank project does not provide support across the value chain, rather it focuses on the development of institutional capacity of quality infrastructure units.

The regulatory bodies have a generic regulation that applies to those which fall under the food category, but there is no specific regulation that applies to honey, and so far the food regulation is not applied to honey. Therefore, the regulatory bodies shall develop a system and directives on how they collaborate with regional regulatory bodies to support in maintaining the quality of honey that ultimately ensures the health of consumers.

There are no conformity assessment bodies specifically for testing, calibration and inspection of service providers at a closer distance to the production area that supports the verification of the quality compliance in each step of the value chain. All the conformity assessment services are concentrated in the capital city, Addis Ababa or close to Addis Ababa.

The Ethiopian Meat and Dairy Industry Development Institute situated at Bishoftu, Oromia, which is 45 km away from Addis Ababa, is in the process to amend its regulation to include-research based support for increasing the productivity and quality of honey in their mandate. Holeta Research Laboratory situated at Holeta, Oromia, which is 35 km away from Addis Ababa, is one of the institutions conducting research to support increaasing the productivity and quality of honey. The Tigray Soil Research Laboratory, which is 780 km way from Addis Ababa, has opened Honey Research Center to support the productivity and quality of honey. However, these three institutions have limited capacity in terms of experts, reagents, PT, CRM, lab equipment and closer calibration service. Besides the above limitations, the institutions did not develop and implement a system according to the requirements of ISO/IEC 17025 for the international acceptability of their services or research outcomes.

Tigray Bureau of Science and Technology is providing non-accredited mass calibration services, but the calibration service is not traceable besides this, the scope of its service is very limited. It needs to extend its service of calibration for temperature, pressure, volume, APM, balance, etc. and implement ISO/IEC 17025 for accreditation. If it is supported by this project it might become a very useful testing laboratory to get calibration service at closer distance. The above three research centers can also be supported according to their gaps.

1. Tigray Honey Research Centre situated under Tigray Soil Research Centre in Mekelle. This centre was recently established and it is at closer distance to the producers to provide support to beekeepers and other honey actors in the value chain. The support might take the form of:

a. Training on the selected schemes based on acceptance at global, regional and national level (the schemes can be product certification, organic certification, good agricultural practices, etc.)
b. Material support that supports the verification of quality across the value chain; it could be provided through a mobile testing laboratory
c. Providing the necessary support to accredit their conformity assessment services, like training and consulting to understand, develop and implement ISO/IEC 17025, facilitate for PT participation, provide certified reference materials and support to calibrate their measuring equipment

2. Holeta Honey Research Centre, Oromia, situated 35 km away from Addis Ababa; the centre has not major scientific instruments, hence, the support shall focus on:

a. Purchasing of scientific equipment for residual testing,
b. Providing axulary chemicals,
c. Facilitating PT participation,
d. Providing certified reference materials,
e. Training on the standard ISO/IEC 17025.

However, the centre is not at closer distance to support the beekeepers.

3. The Ethiopian Meat and Dairy Industry Development Institute does not have major scientific equipment. Researchers of the institution are doing their experiments by outsourcing from ECAE and Bless, hence, the support shall focus on:

a. Purchasing of scientific equipment to test residuals,
b. Providing axulary chemicals,

c. Facilitating PT participation,
d. Providing certified reference materials,
e. Training on the standard ISO/IEC 17025.

The iinstitution is accountable to the Federal Government and reporting to the Ministry of Trade and Industry and its support focuses on the industrial processes, not on the production of honey.

8.2 Enhance SME compliance with international standards and technical regulations:

At the country-level, there is no clear information or source of information on the number of small and medium enterprises engaged in the honey production sector. However, from the suitability of the environment, and natural or governmental /non-privatized forest used for bee forage and of its easy to make cash crop, many household farmers are engaged in beekeeping. However, they are not productive and cannot easily change their living standards. This is because of:

- The beekeepers are producing honey in substandard manner, not following standard procedures while producing honey;
- Even though ESA had developed a honey specification (ES 1202:2015), the requirement is communicated neither to the agricultural extension service supporters nor to the beekeepers;
- Despite the presence of strong agricultural extension services and adequate development agents at every level, the attention given to the beekeeping extension service is very low or almost nil;
- Un-optimized application of various agro-chemicals (herbicides pesticides) affects the honeybee population, productivity of honeybee colonies; contamination of honey with the chemicals can lower the quality and quantity of honey;
- There is no quality infrastructure extension service like mobile calibration, mobile testing, etc. at the beekeeping sites;
- Even though labeling is a mandatory requirement, honey is mostly marketed without labeling, which makesit difficult to trace the original source of the marketed honey;
- The system is susceptible for adulteration, this affects the genuine beekeepers;
- Research support is not based on the need and problems of beekeeping, rather done for academic career development;

- Support is not directed across the whole value chain, rather towards control or testing to ensure the quality of the final product ready for consumption by the consumer;

These problems are significantly affecting the development of SMEs, if the problems were to be mitigated, a reasonable number of household farmers might become engaged in beekeeping.

8.3 Strengthen culture of quality across the honey value chain, to improve reputation, add more value to the honey production, and increase demand for Ethiopian honey:

Even though the climate is conducive to beekeeping, there are many constraints at a national level for the improvement of low productivity and low quality of honey. Many beekeepers use traditional methods or demonstrate low adoption of improved beekeeping technology. This is because of weak or non-extension services given to apiculture compare to the other agricultural activities, no available structure to assign beekeeping extension service workers, and because the agriculture extension workers are not trained to support the beekeepers. Therefore, there is an extension service gap in assistance at different levels to beekeepers by the extension service providers.

The use of large quantities of various agro-chemicals, herbicides and insecticides are affecting the honey bee colonies population because the chemicals kill a large number of honey bee colonies and also affect the forage, a practice which ultimately lowers productivity and quality of honey bee colonies. Honey harvesting also needs to follow a certain optimal procedure to safeguard the quality; using excessive smoke can affect the taste and aroma of honey; many beekeepers use containers made up of clay, gourd and tin to store honey, but such containers are susceptible to drawing moisture because they do not have tight-sealing lids and also affect the odor of the honey; in forest beekeeping, when beekeepers are seeking cash they harvest unripe honey which is susceptible to drawing moisture, which facilitates fermentation; and during harvesting, a lack in hygiene is also a factor for quality failure. In general there is no Good Apiculture Practice or organic production certificate according to the requirements of which the beekeepers produce to ensure consistency and similar honey production.

Since honey is a seasonal product, it is required to buy an adequate volume of honey during harvest season to have sufficient stock for annual processing, and the

cooperatives and private companies have no sufficient capital to purchase for annual process and also no store that complies the standard requirement to store honey for the annual process, as a result they cannot consistently process and supply their products to their customers.

The majority of beekeepers live in remote areas and in a scattered manner, which makes it difficult to connect by road infrastructure to the collective centres, hence, farmers are transporting their product by foot, men carrying it on their shoulders, and women carrying it on their backs, or by donkey. While transporting honey in a traditional way, it will likely be exposed to high temperatures and sunlight that makes the honey melt and contaminated by the surrounding diffusible moisture and odor. Therefore, extraction, storing and transportation require its own standard that supports maintaining the quality of honey.

Most of the cooperatives are not equipped with appropriate and sufficient processing equipment that upgrade the quality of honey by using them. The packaging and labeling shall also be to the standard that avoids contamination from external pollutants and that is able to give the necessary information and quality mark for the consumers. There is no common process requirement as for Good Manufacturing Practices or Food Safety Management System followed by the processors and no verification of quality compliance of the honey by competent conformity assessment bodies before delivery to the market.

The export market is very small compared to the domestic market because of low product quality through adulteration, illegal cross border trade, high quality attestation certificate request /demand by importing countries, and a good price in the local market.

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