

## Transforming Apiculture for Food and Nutrition Security in Tigray Region (Apiculture beyond production)

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### EXECUTIVE SUMMARY

Apiculture is a promising off-farm enterprise, which directly and indirectly contributes to smallholder's income in particular and nation's economy in general. Tigray region is blessed for different colors of honey, particularly is known for its specialty white honey. The white honey, produced from a special unique floral of highland and midlands of the region is with high demand and fetches remarkable price in the domestic and international markets. Using combined methodological method, the study was addressed the issues mentioned in the document. The overall approach of the study was conducted through situational analysis, review of literatures, expert opinion and conference inputs. The opportunities, strategic objectives and actions, existing challenges and recommended strategic interventions of the apicultural sub-sector have thoroughly addressed in this document. It is known that, beekeepers realizing that vegetations are a source of forage for honeybees would guard against the destruction and be encouraged to plants, more plants for supplying pollen and nectar. It is concluded that apiculture sub-sector is known for food and nutrition security as well as ecological restoration of our plant.

Therefore, apiculture sub-sector due attention more importantly in research and technology to attain its goal in food and nutrition security, income generation and job creation and for climate resilient agriculture.

### 1. INTRODUCTION

Agriculture is an important subsector to the survival of about 2 millions of people in Ethiopia. Apiculture is one of the agricultural subsectors that has been an integral part of agriculture in Ethiopia. The country has a substantial potential for apiculture development. The ideal climatic conditions and diversified floral resources allow the country to sustain around 6.5 million hived honeybee colonies (CSA 2016/18) and some literatures stated that 30% of the countries honeybee colonies are feral honeybees or exists in forests as wild colonies (MoARD, 2007). Tigray region is blessed for different colors of honey, particularly is known for its specialty white honey. The white honey, produced from a special unique floral of highland and midlands of the region is with high demand and fetches remarkable price in the domestic and international markets. However, the subsector is untapped and needs improvement. Bee product (honey and beeswax) in Tigray region is an old long lasting experience in most rural people. The region has also favorable climatic condition and floral diversity. Land in Tigray is rugged mountains and is scarce, and many farm sizes are very small (below 1ha). Many women, especially widows, and young people who have little access to land struggle to produce enough to feed their families. For this reason, bee product is not only an alternative income generating activity but also the main commodity for most of the rural people in the region. Accordingly, the regional government has prioritized apiculture as a strategic enterprise, classifying more than 70% of the districts in the region as "honey clusters", earmarking honey enterprises for strategic funding and support (<https://www.farmafrica.org>). The introduction and diffusion of frame hives is promising in the region as it shares 29% of honey production obtained from the improved frame hive and accounts for approximately 10% of total honey production nationally (CSA,

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2017). In addition, crops pollinated by bees have been proven to produce higher yields and better quality, often at no extra cost for the farmer, rather crop seed yield increment. Apiculture contributes to environmental sustainability and proves to be effective in reducing degradation and consequently adapt to climate change impacts. As per the document (Bradbear, 2009) apiculture is a non-destructive activity that could be employed in the conservation of biodiversity in protected areas so that it stabilizes fragile areas and help in reclaiming degraded lands and increases biodiversity. Apiculture in the region is providing an immediate incentive for local people from the environmental rehabilitation programs. Therefore, the purpose of this paper is to indicate the major challenges and opportunities in the beekeeping subsector and suggest potential options for developing the subsector in Tigray regional state of Ethiopia.

## 2. APPROACHES USED

This work followed combination of methods to address the issues mentioned in the document. The overall approach of the study was conducted through situational analysis, review of literatures, expert opinion and conference inputs. The strategic document preparation was initiated by the Global Society of Tigrean Scholars (GSTS) established in Tigray region. The task force working on the apiculture strategic document was established from different institutions actively working in the beekeeping subsector. The first draft document was prepared by this team of experts from experts' opinion and experience in the sector, literature review. The first draft document was presented to the livestock sector core team for further enrichment. After incorporating the comments from this team the second draft was prepared and presented at the annual conference of the GSTS held from July 28 to August 1 2019. The working team incorporated the comments into this strategic document. To develop the beekeeping subsector, the bottlenecks need to be overcome through the strategic interventions given due attention in this document. The **situational analysis** composed of the following points.

**Apiculture opportunities:** Apiculture is a promising off-farm enterprise, which directly and indirectly contributes to smallholder's income in particular and nation's economy in general. It has significant role in generating and diversifying the income of subsistence Ethiopian smallholder farmers mainly the small land holders and the landless poor (EARO, 2000). Realizing the magnitude and severity of the food insecurity challenge, the Tigray government has taken beekeeping sub sector as one of the strategies to

improve food security of rural households. The opportunities which are dominantly explained are:-

**Indigenous knowledge and skill in beekeeping:** Long year tradition of beekeeping by the farming community in Tigray region. Beekeepers gained experiences on how to integrate them with other agricultural practices. As a result, honeybees already play viral role in the social and economic aspect of the farming community.

**Natural resource endowment:** suitable agro-ecologies, bee floras, locally adapted honeybee species and human capital are sufficient enough drivers to improve colony and honey production. The presence of some improved skills and experiences, and knowledge in bee product for improved productivity exist.

**Integrated watershed management:** To ensure food security, a number of programs have been implemented among which are watershed management in the region. There are plenty of non-arable lands that have been put under area enclosure. This has created opportunity for increased bee forage diversity and cover-abundance, and availability of water and suitable apiary sites for bee product development that enables to organize, capacitate, guide and engage many landless youths in bee product business.

**Growing end market:** Three large industrial-scale honey processors and exporters (Dimma Bee-keeping Development and Honey Processing PLC, Welela Bee-keeping and Honey Processing Plant (Comel PLC) and Ahadu Bee-keeping and Honey Processing Plant PLC are operating within the region and have expressed interest in the establishment of dedicated collection centers that provide bulking facilities and a guaranteed market for farmers. The processors are also committed to providing apiculture advisory services to ensure modern bee product practices are maintained. In addition to this there is local retail domestic market demand. Domestic demand is also driven by local wine known as "Tej" of which honey is a key ingredient. Similarly, many primary and unions are emerging and have high interest to engage in bee product and processing such as Meles Union, Samre Union, and Bokra union.

**Bee-keeping can be practiced by Women and Landless Youth:** With relatively low startup costs and minimum land requirements, beekeeping offers high potential for outreach among safety net beneficiaries. Cooperative-based production schemes offer opportunity for the landless and youth on communal lands. The non-labor intensive aspects of bee-keeping are favorable for women. For those beneficiaries engaged in other types of farming, bee-keeping can complement already-existing crops by increasing production through pollination while promoting

biodiversity. Honey is also a stable commodity with a relatively long shelf life, and may serve as a risk mitigation strategy as an additional income stream.

**Unique honeybee floras for unique Tigray white honey:** obtaining from the nectar-yielding vegetation and favorable climatic conditions Tigray honey is able to produce a unique white cream honey with relatively low moisture content. The potential exists to exploit this high quality variety with a branding campaign on the international market.

**Multipurpose Support Service Industries:** The presence of micro finance institutes at grass-root level. The advanced bee-keeping sector supports a number of off-farm industries in towns/cities, including garment manufacturing, as well as bee-hive box and honey extractor construction. Additional uptake of bee-keeping will serve as a stimulus particularly among Micro and Small Enterprises (MSEs) operating in the wood-work and metal-work sector. Since recently, the users of improved hives and appropriate bee product equipment and accessories are increasing

**Favorable development policies:** Foreign investment and Climate resilient green economy policies encourage commercial level investment in the beekeeping sector.

**Rising demand for organic and specialty bee products:** Currently there is growing demand for organic bee products, light colored honey, mono-floral honey in the national and international markets.

**Increasing human population:** demanding apicultural technologies and honeybee products

**Increased demand to invest in apiculture sub-sector:** Due to the promising profit of the beekeeping sector at commercial level farming, investors are joining the sub sector recently.

### 3. Existing challenges of the commodity

The major apicultural constraints and challenges are:

1. **Technical problems:-** Limited Capacity building, there has not been a strategic document prepared for stallholder farmers, investors and urban beekeepers, Limited attention to bee health, pre and post-harvest handling and management, Limited control mechanism for honeybee pests and predators and indiscriminate application of agro-chemicals and he honey processing, packing, storage and container materials are not produced in quantity and quality in the region, and imported goods are more expensive. Limited attention on improvement of the genetic lines of honeybees to maximize production potential. There is no experience in the region on bee product processing to produce new cosmetic, food and pharmaceutical products.

2. **Non-technical problems:** weak practices to use improved bee product inputs, delay for loan repayment of the revolving fund affects other beneficiaries and low quality and high price of inputs.
3. **Market related problems:** Low supply of bee products, limited knowledge of producers on honeybee colony management, processing and handling, no grading system for bee product quality and price, no traceability system, honey and beeswax adulteration and no sustainable institutions to collect and sell small produce of beekeepers for international market.
4. **Institutional problems:** Limited infrastructure (training center and laboratory), weak sustainable extension service, and weak leadership for integration of agrochemical application and apiculture overall development.

### 4. STRATEGIC OBJECTIVES AND ACTIONS

The ideal climatic conditions and diversified floral resources allow Ethiopia to sustain around 6.5 million hived honeybee colonies. This makes the country with the largest number of honeybee colonies in Africa. The huge resources in the country coupled with ancient culture of the people of the country ranked one of the largest honey producers which makes 1<sup>st</sup> in Africa and 10<sup>th</sup> in the world and the third largest beeswax producer worldwide. Moreover, the country's potential for honey and beeswax production is expected to be 500,000 and 50, 000 tons per year for honey and beeswax respectively. This indicated that, the country potential hasn't yet utilized, only approximately about 10% of the honey and wax potential have been tapped, and the commercialization of other high value honeybee products such as pollen, propolis, royal jelly and bee venom is not yet practiced at a marketable volume, even not yet recognized. We can take an example how countries work to boost the productivity and what method they follow. China owns an estimated of seven million managed honeybee colonies, of which about 5 million are Western lineages (*Apis mellifera*) and the others are indigenous Eastern honeybees (*Apis ceranacera*) which is really back in the yield of honeybee products. In China, the annual yield of honey is approximately 300,000 metric tons and the other nationwide bee product production estimates for recent years are around: 3,000 metric tons of royal jelly; 5,000 metric tons pollen; 4,000 metric tons beeswax; 350 metric tons of propolis (Zheng, Wei, Hu, & Hu, 2016). The success of apiculture to be advanced in China is

resulted because of government focus, emergence of honeybee breeding for honey and royal jelly production, innovation of honeybee equipment and machines, improvement of feeding techniques, rapid progress of pollination services, increase variety of bee products, strong linkage between beekeeping cooperatives, industries, Research centers and University Research centers are the leading for generating technologies, continued flowering seasons/diverse and plenty of honey bee forage, strong professional beekeeping cooperatives, motivation for innovations and aiming high. Tigray region belongs to the dry land areas, which is characterized by sparse and uneven distribution of seasonal rainfall and frequent draught. Because of the frequent draught and low agricultural productivity, food deficit is the central challenges of the region. More of this, more than 70 % land use land cover is not suitable for cultivable lands (BoFED, 2007). This area is suitable for bee product production. Surprisingly, the region has done a great effort on soil and water conservations and protecting the lands against external interventions. This document highlights specific interventions required to accelerate the development and growth of the apiculture sector in the region. These interventions are aimed at addressing the constraints, countering the sector threats and taking advantage of the opportunities. The recommended strategies are summarized in the following Table.

Strategic Issue	Strategic Intervention		
	Short-term (1-3 years)	Medium-term (4-6 years)	Long-term (7-10 years)
1 Lack of trained manpower in apiculture	<p>Short term trainings on: -</p> <ul style="list-style-type: none"> <li>• modern laboratory equipment and tools</li> <li>• Technical training for experts and researchers that support the subsector on integration, basic skill training in beekeeping</li> </ul>	<ul style="list-style-type: none"> <li>• Researchers or technicians trained or specialized in modern instruments and tools</li> <li>• Researchers specialized in advanced research disciplines</li> </ul>	<ul style="list-style-type: none"> <li>• Researchers or technicians trained or specialized in modern instruments and tools</li> <li>• Researchers specialized in advanced research disciplines</li> </ul>
2 Limited research infrastructure and facilities (laboratory, lab facilities, digital library, standard store, greenhouse, herbarium, insectary, etc)	<ul style="list-style-type: none"> <li>• Establishment of standard laboratory, herbarium and honey quality analysis and AI instruments</li> <li>• Availing some basic molecular biology materials such as Laminar hood, DNA extraction tools, soxhlet extractor, Gel electrophoresis and PCR etc</li> </ul>	<ul style="list-style-type: none"> <li>• Establishment of metal workshop, standard insectary and greenhouse</li> <li>• Availing some advanced quality analysis equipment</li> </ul>	<ul style="list-style-type: none"> <li>• Continue to modernize the lab facilities to attain state of the art in biotechnological and quality analyses</li> </ul>
3 Poor linkage of the research system with other stakeholders along the value chain	<ul style="list-style-type: none"> <li>• Strengthening already established apiculture research centers</li> <li>• Strengthening apiculture development stakeholders' platform</li> <li>• Promote Ethiopian honey and beeswax to establish promising market linkages in the honey value chain.</li> </ul>	<ul style="list-style-type: none"> <li>• Continue strengthening the apiculture development platform</li> <li>• Establishing new international and national stakeholders' platform</li> </ul>	<ul style="list-style-type: none"> <li>• Continue strengthening the national and international apiculture development platforms</li> </ul>
4. Institutional arrangement	<ul style="list-style-type: none"> <li>• Bee research and training center establishment</li> <li>• Re-structuring extension service</li> <li>• Revitalizing farmer cooperatives</li> <li>• Functionalizing laboratories</li> </ul>	<ul style="list-style-type: none"> <li>• Establishing beekeepers' association</li> <li>• Commercializing extension system through the use of well experienced beekeepers to support the extension system.</li> </ul>	<ul style="list-style-type: none"> <li>• Accreditation of associations, research centers, laboratories</li> </ul>
4. Low productivity and production of honeybees	<ul style="list-style-type: none"> <li>• Characterize and select better performing indigenous stocks</li> <li>• Development of suitable colony multiplication techniques</li> <li>• Establishment of community based bee breeding stations</li> <li>• Adopting AI technologies</li> </ul>	<ul style="list-style-type: none"> <li>• Breeding of selected stock lines</li> <li>• Use biotechnological tools to characterize and study genetic variations</li> <li>• Generate genetic information on traits of importance for local bees (i.e., elucidating the biological basis for productivity gains by quantifying the patterns of genetic variabilities, inheritance, gene effects, genetic predictions and other variables</li> </ul>	<ul style="list-style-type: none"> <li>• Continuing breeding of better performing stock lines</li> <li>• Continuing generating information on traits of important for local bees</li> </ul>
5. Poor beekeeping management techniques	<ul style="list-style-type: none"> <li>• Development of improved bee management techniques suitable for different agro-ecologies and seasons</li> <li>• Minimize colony mobility (swarming, absconding, migration)</li> <li>• Identifying standard ration for local honeybees</li> <li>• Prepare standardized modules for training of stakeholders involved in the subsector</li> </ul>	<ul style="list-style-type: none"> <li>• Developing specific management techniques for production of other honeybee products (pollen grains, royal jelly, venom, etc)</li> <li>• Continuing developing improved bee management techniques for different agro-ecologies</li> <li>• Characterizing and developing standard ration for local honeybees</li> </ul>	<ul style="list-style-type: none"> <li>• Continuing developing improved bee management techniques for different agro-ecologies and diversified bee products</li> <li>• Continuing characterizing and developing standard ration for local honeybees</li> </ul>
6. Underutilization of potential bee forages	<p>Identifying, characterizing and mapping major bee forages</p> <p>Establishing honey floral calendar and colony carrying capacity for different AEZ</p> <p>Collection and documentation of reference bee forage materials (herbarium specimen, pollen grain references, etc)</p>	<p>Continuing identifying, characterizing and mapping major bee forages</p> <p>Continuing establishing honey floral calendar and colony carrying capacity for different AEZ</p> <p>Continuing collection and documentation of reference</p>	<p>Continuing identifying, characterizing and mapping major bee forages</p> <p>Continuing establishing honey floral calendar and colony carrying capacity for different AEZ</p>

Strategic Issue	Strategic Intervention		
	Short-term (1-3 years)	Medium-term (4-6 years)	Long-term (7-10 years)
		bee forage materials (herbarium specimen, pollen grain references, etc) Developing bee forage agronomic recommendations and multiplication techniques Evaluating and adopting introduced technologies Establish nurseries for bee forages	Continuing developing bee forage agronomic recommendations and multiplication techniques Continuing collection and documentation of reference bee forage materials (herbarium specimen, pollen grain references, etc)
7. Underutilization of honeybee pollination services for crop yield improvement and natural resource conservation	Assessing the contribution of bees in natural resource conservation and crop yield <ul style="list-style-type: none"> <li>Identifying and evaluating potential pollinators other than honeybees</li> <li>Identifying and evaluating pollination affecting factors</li> <li>Integrating beekeeping with other agricultural and natural resource conservation practices</li> </ul>	Assessing the contribution of bees in natural resource conservation and crop yield <ul style="list-style-type: none"> <li>Identifying and evaluating potential pollinators other than honeybees</li> <li>Identifying and evaluating pollination affecting factors</li> <li>Integrating beekeeping with other agricultural and natural resource conservation practices</li> <li>Developing adaptation and mitigation mechanisms against pollination limiting factors</li> <li>Evaluating and adopting technologies mitigating pollination limiting factors</li> </ul>	Assessing the contribution of bees in natural resource conservation and crop yield <ul style="list-style-type: none"> <li>Identifying and evaluating potential pollinators other than honeybees</li> <li>Identifying and evaluating pollination affecting factors</li> <li>Integrating beekeeping with other agricultural and natural resource conservation practices</li> <li>Continuing developing adaptation and mitigation mechanisms against pollination limiting factors</li> <li>Continuing evaluating and adopting introduced technologies</li> </ul>
8 Increasing loss of honeybee colonies due to indiscriminate use of pesticides	Availing information on the potential toxicity effect of pesticides on honeybee and their product Identifying toxicity aggravating factors (time, duration, mode of application, formulation, etc) Developing techniques to minimize toxicity effect of pesticides Creating awareness on the proper use of pesticides (agro-chemicals) Providing feedbacks/evidences to support policy makers	Availing information on the potential toxicity effect of pesticides on honeybee and their product Identifying toxicity aggravating factors (time, duration, mode of application, formulation, etc) Developing techniques to minimize toxicity effect of pesticides Creating awareness on the proper use of pesticides (agro-chemicals) Providing feedbacks/evidences to support policy makers	Availing information on the potential toxicity effect of pesticides on honeybee and their product Identifying toxicity aggravating factors (time, duration, mode of application, formulation, etc) Developing techniques to minimize toxicity effect of pesticides Creating awareness on the proper use of pesticides (agro-chemicals)
9. Poor product processing and handling	Generating and adopting improved bee product processing and handling technologies <ul style="list-style-type: none"> <li>Developing quality control and grading system for honey and beeswax</li> <li>Developing protocol to identify adulteration of bee products</li> <li>Creating awareness on quality management</li> <li>Develop new products form bee products as ingredients</li> </ul>	Generating and adopting improved bee product processing and handling technologies <ul style="list-style-type: none"> <li>Developing quality control and grading system for pollen and royal jelly</li> <li>Developing protocol to identify adulteration of bee products</li> <li>Generating information on potential risk of bee product contamination</li> <li>Creating awareness on quality management</li> <li>Establish standard quality control facilities for new products</li> </ul>	Generating and adopting improved bee product processing and handling technologies <ul style="list-style-type: none"> <li>Developing quality control and grading system for pollen and propolis</li> <li>Generating information on potential risk of bee product contamination</li> <li>Creating awareness on quality management</li> <li>Establish long-term product safety monitoring system</li> </ul>

Strategic Issue	Strategic Intervention		
	Short-term (1-3 years)	Medium-term (4-6 years)	Long-term (7-10 years)
10. Limited value addition practices and inadequate use of other bee products	<ul style="list-style-type: none"> <li>Developing techniques to diversify the utilization of bee products like honey, beeswax and propolis(value addition)</li> </ul>	<ul style="list-style-type: none"> <li>Diversifying the utilization of bee products (pollen grain)</li> <li>Develop standard for quality check</li> </ul>	<ul style="list-style-type: none"> <li>Developing techniques to diversify the utilization of bee products ( royal jelly and bee venom)</li> </ul>
11. Shortage and high cost of pre &post-harvest bee equipment	<ul style="list-style-type: none"> <li>Evaluating and improving the performances of different pre &amp; post harvesting beekeeping equipment and materials</li> <li>Human resource capacity building for designing and production of pre &amp;post-harvest bee equipment</li> </ul>	<ul style="list-style-type: none"> <li>Evaluating and improving the performances of different pre &amp; post harvesting beekeeping equipment and materials</li> <li>Human resource capacity building for designing and production of pre &amp;post-harvest bee equipment</li> <li>Encourage input production enterprises</li> </ul>	<ul style="list-style-type: none"> <li>Continuing evaluating and improving the performances of different pre &amp; post harvesting beekeeping equipment and materials</li> <li>Continuous monitoring of input providers</li> </ul>
11. Inadequate dissemination of improved Apiculture technologies for users	<ul style="list-style-type: none"> <li>Demonstrating, evaluating and promoting proven technologies</li> <li>Disseminating proven information and technologies</li> <li>Collecting existing knowledge, skill and technologies for dissemination</li> </ul>	<ul style="list-style-type: none"> <li>Demonstrating, evaluating and promoting proven technologies</li> <li>Disseminating proven information and technologies</li> <li>Establish monitoring system for apicultural equipment</li> </ul>	<ul style="list-style-type: none"> <li>Demonstrating, evaluating and promoting proven technologies</li> <li>Disseminating proven information and technologies</li> </ul>
12. Inadequate supply of generated technologies	<ul style="list-style-type: none"> <li>Building modern infrastructures and facilities for technology multiplication</li> <li>Increasing supply of available technologies</li> </ul>	<ul style="list-style-type: none"> <li>Building modern infrastructures and facilities for technology multiplication</li> <li>Increasing supply of available technologies</li> </ul>	<ul style="list-style-type: none"> <li>Increasing supply of available technologies</li> </ul>
12. Climate change	<ul style="list-style-type: none"> <li>Addressing climate change problem in research programs to increase resilience of vulnerable communities</li> <li>Developing early warning mechanisms and tools to address emerging problems</li> </ul>	<ul style="list-style-type: none"> <li>Addressing climate change problem in research programs to increase resilience of vulnerable communities</li> <li>Developing early warning mechanisms and tools to address emerging problems</li> <li>Establish institutional set up for early warning with regard to climate change and other natural disasters that affect the beekeeping subsector</li> </ul>	<ul style="list-style-type: none"> <li>Addressing climate change problem in research programs to increase resilience of vulnerable communities</li> <li>Developing early warning mechanisms and tools to address emerging problems</li> </ul>

## 5. CONCLUSION AND PERSPECTIVES

Apiculture contributes to environmental sustainability and proves to be effective in reducing degradation and consequently adapt to climate change impacts. It is a non-destructive activity that could be employed in the conservation of biodiversity in protected areas so that it stabilizes fragile areas and help in reclaiming degraded lands and increases biodiversity. Beekeepers realizing that vegetation are a source of forage for honeybees would guard against the destruction and be encouraged to plants, more plants for supplying pollen and nectar. In other hand, beekeepers as advocates of sustainable forest management, forest conservation and agronomic practices and the Tigrai Region are found endowed of vegetation which are important for the beekeeping activities. Thus, creating awareness and building the capacity beekeeper on the principles, procedures and advantages of contract farming as part of creating linkage between the producers and buyers is important in order to strengthen the beekeeping business in the Region.

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