



DRAFT
**INVENTORY OF CLIMATE SMART AGRICULTURE
APICULTURE TECHNOLOGIES, INNOVATIONS &
MANAGEMENT PRACTICES**

Kenya Agricultural and Livestock Research Organization

Under

**KENYA CLIMATE SMART AGRICULTURE
PROJECT
(KCSAP)**

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*TIMPs for Honey value Chain in the counties of Nyandarua, Kajiado, Lamu, Siaya and Tana
River counties*

Version 1

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Definition of terms and summary tables of Apiculture, Innovations and Management Practices (TIMPS)

1.0 Definition of terms

Technology: This is defined as an output of a research process which is beneficial to the target clientele (mainly farmers, pastoralists, agro-pastoralists and fisher folk for KCSAP's case), can be commercialized and can be patented under intellectual property rights (IPR) arrangements. It consists of research outputs such as tools, equipment, genetic materials, breeds, farming and herding practices, gathering practices, laboratory techniques, models etc.

Management practice: This is defined as recommendation(s) on practice(s) that is/are considered necessary for a technology to achieve its optimum output. These include, for instance, different agronomic and practices (seeding rates, fertilizer application rates, spatial arrangements, planting period, land preparation, watering regimes, etc.), protection methods, for crops; and feed rations, management systems, disease control methods, etc. for animal breeds. This is therefore important information which is generated through research to accompany the parent technology before it is finally released to users and the technology would be incomplete without this information.

Innovation: This is defined as a modification of an existing technology for an entirely different use from the original intended use. (e.g. fireless cooker modified to be used as a hatchery)

1.1 Summary of Inventory of TIMPs in the Apiculture Value Chain

The inventory process resulted in a total of 7 TIMPs including 0 technology, 3 innovations, and 4 Management Practices, distributed among the 7 sub-themes, as indicated in Table 1.

Table 1: Sub themes and TIMPs

Commodity/VC	Sub-Theme	Technologies	Innovations	Management Practices
Apiculture	Housing of bee colonies	0	1	0
Apiculture	Improved KTBH	0	1	0
Apiculture	Improved Single Box Hive	0	1	0
Apiculture	Strategic use of bee colonies for crop pollination	0	0	1
Apiculture	Regular bee colony inspection	0	0	1
Apiculture	Harvesting, processing and storage techniques for Hive products	0	0	1
Apiculture	Integrated bee pastures (establishment of plants nurseries using climate smart flora)	0	0	1
Overall Total		0	3	4

1.2 Summary of Status of TIMPs in Apiculture Value Chain

The inventory process resulted in a total of 7 TIMPs, out of which 4 TIMPs are ready for upscaling, 3 TIMPs that require validation and 0 TIMPs that require further research in the sub-themes, as indicated in Table 2.

Table 2. Number of TIMPs ready for upscaling, require validation or further research

Commodity/VC	Sub-Theme	Ready for upscaling	Require validation	Further Research
Apiculture	Bee Housing	0	1	0
Apiculture	Improved Kenya Top Bar Hive	0	1	0
Apiculture	Improved Single Box Hive	0	1	0
Apiculture	Strategic use of bee colonies for crop pollination	1	0	0
Apiculture	Regular bee colony inspection	1	0	0
Apiculture	Harvesting, processing and storage techniques for Hive products	1	0	0
Apiculture	Integrated bee pastures (establishment of plants nurseries using climate smart flora)	1	0	0
Overall Total		4	3	0

Table 3: Inventory of Apiculture TIMPs by Category and Status

TIMPs Sub-Theme	TIMPs Title	TIMPs Category	Status
2.1 Colony Housing	2.1.1 Improved Kapkuikui super log hive	Innovation	Ready for upscaling
2.2 Improved hive technology for enhanced honey production	2.2.1 Improved Kenya Top Bar Hive	Innovation	Ready for upscaling
2.3 Enhanced hive occupancy	2.3.1. Improved Single Box Hive	Innovation	Ready for upscaling
2.4 Enhanced crop pollination	2.4.1 Strategic use of bee colonies for crop pollination	Management practice	Ready for upscaling
2.5 Improved beekeeping husbandry	2.5.1 Regular bee colony inspection	Management practice	Ready for upscaling
2.6 Harvesting, post-harvest handling and processing	2.6.1 Honey harvesting, post-harvest handling and processing	Management practice	Ready for upscaling
2.7 Bee foraging options	2.7.1 Integrated bee pastures (establishment of plants nurseries using climate smart flora)	Management Practice	Ready for upscaling

2.0 Detailed Honey Value chain TIMPS

2.1 Colony Housing

2.1.1 TIMP name	Improved Kapkuikui super log hive
Category (i.e. technology, innovation or management practice)	Innovation
A: Description of the technology, innovation or management practice	
Problem to be addressed	Poor honey quality and frequent absconding by bee colonies in typical log hives commonly used by majority of beekeepers in Kenya
What is it? (TIMP description)	Improved log hive for enhancing honey quality and minimizing bee absconding thus improving honey production
Justification	About 80% of honey produced in ASALs come from log hives which experiences reduced absconding during the hot seasons. Frequent mixing of the brood and the pure honey during harvest is common practice with beekeepers because there is no separation between the brood chamber and the honeycombs in traditional log hives, thus lowering honey quality. The main nutrition and health relevant components are carbohydrates, which make it an excellent energy source, especially for children and sportsmen. Besides its main components, the carbohydrates fructose and glucose, honey contains anti-microbials, antioxidants, antivirals, anti-parasitics, anti-inflammatory, anti-mutagenic, anticancer and immunosuppressive components.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Beekeepers (beekeeping groups and individuals)
Approaches to be used in dissemination	Field days, posters, agricultural shows and farmer to farmer visits; model beekeepers
Critical/essential factors for successful promotion	Availability of bee forage and water, reliable honey markets
Partners/stakeholders for scaling up and their roles.	KALRO - Research on hive technologies County governments - promote technology uptake in various counties Self-help groups - promote technology uptake various beekeeping zones) MoALF&I - promote technology uptake in the Country NGOs - promote hive products and publicity/link farmers to markets Supermarkets - buy and sell to final consumers of hive products

C: Current situation and future scaling up	
Counties where already promoted if any	Baringo
Counties where TIMP will be up scaled	Nyandarua, Kajiado, Lamu, Siaya and Tana River
Challenges in dissemination	<ul style="list-style-type: none"> - Inadequate skills in making the log hives with queen excluder - Poor harvesting and packaging methods - Poor marketing systems
Suggestions for addressing the challenges	<ul style="list-style-type: none"> - Train artisans to make the improved hive - Capacity build beekeepers on hive managements, honey harvesting methods and packaging methods, hive products diversification and marketing skills, link beekeepers to service providers
Lessons learned in up scaling if any	<ul style="list-style-type: none"> - The technology is resilient to the effects of extreme weather conditions experienced in the ASAL - Log hives form the highest population of hives in the country and thus need improvement for best honey quality production - Beekeepers hold strong cultural value for log hives which are easy to acquire
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> - There is need for hive products regulations - Protection of regional hotspots for honey production in the country against market branding agencies - Reliable markets for honey - The technology is environmentally friendly therefore any efforts to increase its production will be readily adopted - Enabling policy frameworks to support development and adoption of the technology is in place - The technology is socially acceptable, and any innovation to increase its productivity will be readily adopted - Increased productivity will provide supply to the markets
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 2,500 (USD 25)/ hive
Estimated returns	KES 14,000 in two harvest seasons/year/hive
Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> - Social and cultural factors hinder women from performing apiary management practices - Women have bee sting phobia - Traditionally, hive ownership, honey production and harvesting is considered a man's job in most communities and should be targeted in training

	<ul style="list-style-type: none"> - While honey bulking is done by the youth, women are involved in marketing
Gender related opportunities	<ul style="list-style-type: none"> - Youth to be encouraged to take up artisanship, while women to sell honey and hive products - Adoption will lead to enhanced product diversity and hence resilience; increased yields towards food and nutritional security
VMG issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> - Due to their social status VMGs are often excluded from decision making in development and dissemination - VMGs face the barrier of accessing the super log hives due to inadequate of resources
VMG related opportunities	<ul style="list-style-type: none"> - Need to enhance market linkages to trigger increased production - VMG can be trained as artisans to sell hives to beekeepers - The VMG can be involved in sale of honey and honey products for income and improved nutrition - Affirmative action, capacity building and practical support to be provided
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Farmers who adopted this technology sustained their bee colonies throughout the dry season. The Kapkuikui beekeeping groups in Baringo is one such group which sells a gallon (4.5 kg) of honey at KES 1,500 minimum (\$10.2). This helped pay school fees and buy food for the family. This has transformed their livelihood for better.
Application guidelines for users	Refer to Super log hive technical brochure (http://www.kalro.org/fileadmin/publications/brochuresII/Honey_production_in_dry.pdf)
F: Status of TIMP readiness (1-ready for upscaling;, 2- requires validation; 3-requires further research)	Requires validation
G: Contacts	
Contacts	Director, KALRO Apiculture Research Institute (ARI), Marigat
Lead organization and scientists	KALRO: Remy Tuey and Richard Kimitei
Partner organizations	CBOs, Extension service providers (Kajiado, Nyandarua, Siaya, Lamu and Tana River) Counties

Research gaps

1. Need for technologies to enhance colonization including innovations of Indigenous Technology Knowledge (ITK) to enhance beehive colonization in the targeted counties

2. Bee Characterization for conservation and breeding purposes in the targeted Counties

2.2 Enhanced crop production using honeybees as pollinators

2.2.1 TIMP name	Use of bee colonies to pollinate crops to enhance crop production
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	Insufficient pollination of fruits and seed crops
What is it? (TIMP description)	Using bee colonies for pollination of crops for increased yields and quality
Justification	About 75% of horticultural crops require honeybee pollination. Introduction of bee colonies in these crop fields enhances pollination and fruit set. Honeybees gather pollen and nectar for their survival, they pollinate crops such as apples, cranberries, melons, carrots and broccoli. Some crops, including blueberries and cherries, are 90% dependent on honeybee pollination. Almonds, depend entirely on the honeybee for pollination
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Beekeepers, fruit orchard growers
Approaches to be used in dissemination	Model growers per sub county; field days
Critical/essential factors for successful promotion	Beekeepers, horticultural growers
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • KALRO- generate management practices • National Beekeeping Station - collaborators and mobilization of farmers • International Centre of Insect Physiology and Ecology (ICIPE) - for technology generation • Horticultural growers - for on farms trials
C: Current situation and future scaling up	
Counties where already promoted if any	Kakamega
Counties where TIMPs will be up scaled	Nyandarua, Kajiado, Lamu, Siaya and Tana River counties
Challenges in dissemination	Lack of model growers who have adopted the technology and can be used for training
Suggestions for addressing the challenges	Model growers' demonstrations would create awareness and willingness to invest in the management practice
Lessons learned in up scaling if any	- Improved beehives can greatly enhance production of quality honey in Kenya

	<ul style="list-style-type: none"> - Improved hives provide a pool of worker bees enough for orchard production - Improved hives can be adopted through new beekeepers mainly youths
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> - Bee keeping is socially acceptable and any technology to increase its production will be readily adopted - Enabling policy frameworks to support development and adoption of the technology is in place - Existence of suitable bio-physical environments in target counties - Availability of ready market for honey and the byproducts - Need for regulations for honey trade - Appropriate honey harvesting and packaging practices are available
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 150,000 for a kit comprising of improved hive package and harvesting package
Estimated returns	By third year all costs of production are paid for
Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> - Social and cultural factors hinder women from performing apiary management practices - Women have bee sting phobia - Women's triple role may hinder them from attending training sessions - Men own the hives and are the decision makers on beekeeping and should be targeted during training
Gender related opportunities	<ul style="list-style-type: none"> • Encourage the youths especially boys/men in the the fabrication of different hive types. Follow this with capacity building sessions. • Women also need to be encouraged on matters packaging and marketing • If adopted by any gender especially men who own beehives it will lead to increased yields therefore enhanced food and nutritional security. • If adopted by men, women and the youth it lead to enhanced product diversity of value chains hence increased resilience • The technology is acceptable and easy to upscale by males and the youth
VMG issues and concerns in adoption and scaling up	<ul style="list-style-type: none"> • Due to their social status VMGs are often excluded from decision making in development and dissemination improved hives for enhanced honey production • VMGs face the barrier of accessing improved hives due to low purchasing power
VMG related opportunities	<ul style="list-style-type: none"> • Honey can provide food and nutrition security and a window for increased income

	<ul style="list-style-type: none"> • Increased production will lead to increased consumption of nutritious honey, hence improved health of VMGs; • Affirmative action is required to promote the usage of improved hives for the VMGs • The indigenous community (Okiek, Yaaku and Sengwer) can use the improved hive
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Mwingi honey marketplace which was established by ICIPE in Kitui county. It continues to exist more than 5 years after the project exit. The market outlet has helped the group market their honey collectively at competitive prices. Their honey is branded by KEBS and thus its of high quality
Application guidelines for users	<ul style="list-style-type: none"> - Adhere to detail/specifications and avoid fabrications that do not meet minimum standards - Refer to Beekeeping brochure by KALRO
F: Status of TIMP readiness (1-ready for upscaling; 2- requires validation; 3-requires further research)	Ready for upscaling
G. Contacts	Institute Director ARI, Marigat
Lead organization and scientists	National Museums of Kenya (Mary Gikungu) Remy Tuey and Richard Kimitei (KALRO)
Partner organizations	National Museums of Kenya

Research gaps

1. Assessment of Honeybee exposure to agro chemicals. and its implication in honey production. in Nyandarua, Kajiado, Lamu, Siaya and Tana River counties
2. Evaluation of pollen deficit in selected crops in the target counties
3. Establish economic value of pollination by honeybee

2.3. Improved beekeeping husbandry

2.3.1 TIMP name	Improved beekeeping husbandry
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low honey production, hive siting, bee absconding
What is it? (TIMP description)	Improved beekeeping practices (proper apiary siting, regular inspection and disease/pest management). This practice enhances honey production

Justification	Poor apiary siting leads to frequent colony absconding, low colony occupancy leading to low honey production
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Beekeepers (beekeeping groups and individuals)
Approaches used in dissemination	Field days, posters, agricultural shows and farmer to farmer visits, on farm demonstration
Critical/essential factors for successful promotion	Bee forage availability and water, reliable honey markets, security
Partners/stakeholders for scaling up and their roles	KALRO - Research on the technologies County governments - promote technology uptake in various counties Self-help groups - promote technology uptake various beekeeping zones) NGOs - promote hive products and publicity/link farmers to markets
C: Current situation and future scaling up	
Counties where already promoted if any	Baringo
Counties where TIMPs will be up scaled	Nyandarua, Kajiado, Lamu, Siaya and Tana River
Challenges in dissemination	Inadequate knowledge in hive management by beekeepers
Suggestions for addressing the challenges	Training of beekeepers on improved beekeeping managements practices
Lessons learned in up scaling if any	<ul style="list-style-type: none"> - Inconsistent inspection and harvesting leads to pest infestation and losses in honey yields - Climate variability in the ASALs leads to high temperatures in the hives and colony
Social, environmental, policy and market conditions necessary for development	<ul style="list-style-type: none"> - Bee keeping is socially acceptable and any technology to increase its production will be readily adopted - Enabling policy frameworks like the Big 4 Agenda in on nutritional security - Existence of suitable bio-physical environments in target counties - Availability of reliable honey market
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Varies with hive types and regions
Estimated returns	Varies with different hive types
Gender issues and concerns in Development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> - Traditionally, hive inspection, cleaning, harvesting is considered a man's job in most communities. Honey bulking is done by the youth and marketed by women - Social and cultural factors hinder women from performing apiary management practices - Women have bee sting phobia
Gender related opportunities	<ul style="list-style-type: none"> - Youth should be encouraged to take up honey bulking, processing, while women sell honey and hive products.

	<ul style="list-style-type: none"> - Enhanced product diversity of value chains hence increased resilience - Increased production will lead to increased income
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> - The vulnerable and marginalized groups (VMG) can be involved in beekeeping as a CIG and sell honey and hive products for income - VMGs face the barrier of accessing improved hives due to inadequate resources - Due to their social status VMGs are often excluded from decision making in development and dissemination - Due to their social status VMGs are often excluded from training pertaining to this management practice (proper apiary siting, regular inspection and disease/pest management)
VMG related opportunities	<ul style="list-style-type: none"> - VMG can brand their hive products for sale for income generation - Affirmative action, capacity building and practical support to be provided - The management practice can provide food and nutrition security and a window for increased income. - Enhance market linkages to trigger increased production.
E: Case studies/profiles of success stories	
Success stories from previous similar projects	<p><u>Baringo County:</u> Rachemo beekeepers, Kapkuikui beekeepers, Irong beekeepers Association</p> <p><u>Makueni County:</u> Kibwezi women beekeepers group</p> <p>These groups have embraced these best apiary management practices and have benefited</p>
Application guidelines for users	Refer to guidelines on beekeeping brochure available on (http://www.kalro.org/fileadmin/publications/brochuresII/Honey_production_in_dry.pdf)
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for upscaling
G. Contacts	
Contacts	Institute Director, KALRO ARI Marigat P.O Box 32-30403 Marigat
Lead organization and scientists	KALRO, Remy Tuey, Richard Kimitei
Partner organizations	CBOs, Extension service providers in Kajiado, Nyandarua, Siaya, Lamu and Tana River Counties

Research gaps

1. Disease surveillance in different agro-ecological zones in the study sites in different Counties
2. Production systems: Housing of apiaries to reduce predators (Honey badger) damage, temperature regulation and honey thefts in the in the study sites in different Counties

2.4. Harvesting, post-harvest handling and processing for improved honey quality

2.4.1 TIMP name	Honey harvesting, post-harvest handling and processing
Category (i.e. technology, innovation or management practice)	Management Practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	Poor honey harvesting and processing methods
What is it? (TIMP description)	Beekeepers can greatly enhance value of their hive products through deployment of efficient harvesting and processing methods, this involves use of modern equipment in harvesting, storage and processing
Justification	Old methods of harvesting and processing honey leads to wastage. Ideally the water content in honey should be below 18%. Most buyers will not accept honey with a water content greater than 20%, which is the legal maximum in Europe. Honey with a high-water content will ferment.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Beekeeping communities
Approaches used in dissemination	Model beekeepers, establishing honey processing groups; open days
Critical/essential factors for successful promotion	Willing beekeepers to adopt the technology
Partners/stakeholders for scaling up and their roles	KALRO – to provide technology County government - linkages with farmers and dissemination
C: Current situation and future scaling up	
Counties where already promoted if any	Baringo
Counties where TIMPs will be up scaled	Nyandarua, Kajiado, Lamu, Siaya and Tana River counties
Challenges in dissemination	Aging beekeepers
Suggestions for addressing the challenges	Start with existing beekeeping groups or communities
Lessons learned in up scaling if any	It is possible to work with beekeepers for improving their product value
Social, environmental, policy and market conditions necessary	Regulations on honey and honey trade should be put in place
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 15,000 (initial cost of bee suit and complete harvesting tools)

Estimated returns	KES 14,000 per two harvests/year/hive
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> - Social and cultural factors hinder women from honey harvesting - Women have bee sting phobia - Men are involved in most of the honey harvesting activities, therefore most of the decisions pertaining to bees are made by men - Women's triple role may hinder them from attending training sessions
Gender related opportunities	<ul style="list-style-type: none"> - Youth should be encouraged to take, processing, while women sell honey and hive products. This will lead to women and youth empowerment through increased production and income - Enhanced product diversity of value chains hence increased resilience
VMG issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> - Due to their social status VMGs are often excluded from decision making in development and dissemination process
VMG related opportunities	<ul style="list-style-type: none"> - Affirmative action, capacity building and practical support to be provided - The management practice can provide food and nutrition security and a window for increased income - Enhance market linkages to trigger increased production - Harvesting, processing and packaging and marketing
E: Case studies/profiles of success stories	
Success stories from previous similar projects	The volume of honey produced has increased by 45% in Mwingi, Kitui from 2008. This has increased honey sales and other hive products.
Application guidelines for users	Beekeeping training manual
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for upscaling
G. Contacts	
Contacts	Institute Director, KALRO ARI Marigat P.O Box 32-30403 Marigat
Lead organization and scientists	KALRO, Remy Tuey and Richard Kimitei
Partner organizations	CBOs, Beekeepers

Research gaps

1. Effects of different harvesting, processing and storage methods on honey quality
2. Evaluation of pesticide residues in pollen

- Honey quality (Physico-chemical) analysis along the honey value chain (parameters; moisture, free acidity, Hydroxymethylfurfural, , diastase, reducing sugars, and proline).

2.5 Improved hive technology for enhanced honey production

2.5.1 TIMP name	Improved Kenya Top Bar Hive
Category (i.e. technology, innovation or management practice)	Innovation
A: Description of the technology, innovation or management practice	
Problem to be addressed	Absconding and low productivity
What is it? (TIMP description)	Modified roof design (Gabled roof) to allow ventilation and lower hive temperatures thus minimize absconding
Justification	Bee colony absconding from regular KTBH because of high hive temperature a result of metallic roofing
Region promoted	Arid and Semi-Arid Lands of Kenya
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	All Beekeepers
Approaches used in dissemination	Field days, posters, agricultural shows and farmer to farmer visits, low media, social media, community barazas
Critical/essential factors for successful promotion	Availability of floral resources and trees/timber for hive suspension
Partners/stakeholders for scaling up and their roles	County governments - farmer linkages Extension service providers - for dissemination NGOs - for wider reach in dissemination (outscaling)
C: Current situation and future scaling up	
Counties where already promoted if any	Kiambu, Muran'ga, Isiolo, Siaya Lamu and Kitui
Counties where TIMP will be up scaled	Nyandarua, Kajiado, Lamu, Siaya and Tana River
Challenges in dissemination	limited extension services
Suggestions for addressing the challenges	Increased awareness through social media, and demonstration
Lessons learned in up scaling if any	- Better performance, reduced absconding, etc. - Affordable to majority of beekeepers - More appealing and user friendly to all genders
Social, environmental, policy and market conditions necessary	Socially acceptable and does not lead to environmental degradation. Produces high quality honey good for markets.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 2,500 (USD 25)/ hive
Estimated returns	With 10 hives costing KES 25000, one hive produces an average of 10 kg raw honey harvested twice yields 20 kg.

	Therefore 10 hives yield $10 \times 10 \times 2 = 100 \text{ kg} \times \text{KES } 600$ per kg processed equals KES 120,000. Hive lifespan of 4-6 years.
Gender issues and concerns in development, dissemination, adoption and scaling up	Beekeeping is mainly a man's job in central and eastern Kenya. Change of attitude has led to more youth and women getting more actively involved in apiary establishment, honey processing and marketing.
Gender related opportunities	Has equal opportunities for men, women and the youth but cultural attitudes do not allow women to practice beekeeping
VMG issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> - Vulnerable and marginalized communities can adopt bee keeping through the help of available networks in their County government, NGOs and NARs - Inadequate skills in beekeeping and money to buy beehives could be a hindrance in the adoption of the technology. Hence the need for training.
VMG related opportunities	In come generation from hive products and creation of jobs along the value chain.
E. Case studies/profiles of success stories	
Success stories from previous similar projects	Highly embraced by beekeepers in central and eastern Kenya due to improved honey quality and yields
Application guidelines for users	Similar to those of an ordinary KTBH but with modified roof top and a fixed queen excluder
F: Status of TIMP readiness (1-ready for up scaling; 2- requires validation; 3-requires further research)	Requires validation
G: Contacts	Director, KALRO ARI Marigat
Lead organization and scientists	National Museums of Kenya (NMK) Mary Gikungu Remy Tuey and Richard Kimitei (KALRO ARI)
Partner organizations	NGOS, beekeeping groups

1. Hive performance in different agro-ecological zones in the targeted Counties
2. Effect of roof design modification in KTBH on colony performance in the targeted Counties

2.6 Improved Modern Hive Technology

2.6.1 TIMP name	Improved single Box Hive
Category (i.e. technology, innovation or management practice)	Innovation
A: Description of the technology, innovation or management practice	
Problem to be addressed	Absconding and low productivity

What is it? (TIMP description)	Modified roof design to allow ventilation and lower hive temperatures thus minimize absconding
Justification	Bee colony absconding from regular KTBH because of high hive temperature a result of metallic roofing. Gender friendly. Both KTBH and Box hive are different in designs and production levels
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	All Beekeepers
Approaches used in dissemination	Field days, posters, agricultural shows and farmer to farmer visits, low media, social media. Community Barazas
Critical/essential factors for successful promotion	Availability of floral resources and trees/timber for hive placement
Partners/stakeholders for scaling up and their roles	KALRO – provide technology County governments, extension workers, CIGs, MoALF&I, NGOs – technology dissemination
C: Current situation and future scaling up	
Counties where already promoted if any	Low, mainly in Kiambu, Isiolo, Siaya and Kitui
Counties where TIMP will be up scaled if any	Nyandarua, Kajiado, Lamu, Siaya and Tana River counties
Challenges in dissemination	Limited extension services
Suggestions for addressing the challenges	Increased awareness through social media, and farm demonstrations
Lessons learned in up scaling if any	<ul style="list-style-type: none"> • Reduced absconding • Affordable to majority of beekeepers • It is user friendly to all genders • Easy to manage
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> • Generally accepted in the community and does not lead to environmental degradation. • Produces high quality honey good for markets
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 150,000/ha
Estimated returns	With approximately 100 hive colonies in two acres. One hive produces an average of 12 kg raw honey harvested twice yields 24 kg. Therefore 100 hives yield $100 \times 24 = 2400$ kg x KES 600 per kg processed equals KES 1,440,000 per year. Hive lifespan of 4-6 years.
Gender issues and concerns in development, dissemination, adoption and scaling up	Beekeeping in Kenya is generally a man's job. Change of attitude has led to more youth and women getting more actively involved in apiary establishment, honey processing and marketing.
Gender related opportunities	Has equal opportunities for both gender especially cultural attitudes do not allow women to practice beekeeping. The

	indigenous community (Okiek, Yaaku and Sengwer) can take up this hive
VMG issues and concerns in development, dissemination, adoption and scaling up	Vulnerable and marginalized communities can adopt bee keeping through the available networks in their County governments, NGOs and NARs.
VMG related opportunities	Income generation from hive products and creation of jobs along the value chain
E. Case studies/profiles of success stories	
Success stories from previous similar projects	Slowly embraced by beekeepers in Siaya and eastern Kenya due to improved honey quality and production
Application guidelines for users	Similar to those of an ordinary Langstroth hive but with modified roof top and a fixed queen excluder
F: Status of TIMP readiness (1-ready for up scaling; 2-requires validation; 3-requires further research)	Requires validation
G. Contacts	
Contacts	Director, KALRO ARI Marigat
Lead organization and scientists	NMK, Mary Gikungu Remy Tuey and Richard Kimitei (KALRO Marigat)
Partner organizations	NGOs,

Research Gaps

1. Performance of improved hives in different agro ecological zones in the targeted Counties
2. Determine adoption of new beekeeping technologies and innovations

2.7 Bee foraging options

2.7.1 TIMP name	Integrated bee pastures
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	Bee habitat degradation
What is it? (TIMP description)	Increase bee floral resources for environmental sustainability
Justification	To address increase habitat degradation as a result of overgrazing and human factors such as charcoal burning , shamba system etc.
B: Assessment of dissemination and scaling up/out approaches	

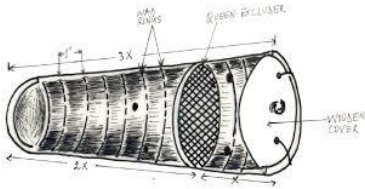
Users of TIMP	Beekeepers and farmers
Approaches to be used in dissemination	Field days, posters, farmer to farmer visits, social media. community barazas
Critical/essential factors for successful promotion	Management and conservation of floral resources
Partners/stakeholders for scaling up and their roles	KALRO – technology and lead role County governments extension workers - Farmer linkages and training)
C: Current situation and future scaling up	
Counties where already promoted if any	Low adoption in eastern Kenya and coastal area
Challenges in dissemination	Poor extension services
Counties where TIMP will be up scaled	Nyandarua, Kajiado, Lamu, Siaya and Tana River counties
Suggestions for addressing the challenges	Increased awareness through social media, and farm demonstrations
Lessons learned in up scaling if any	<ul style="list-style-type: none"> • Habitat conservation and associated ecosystem services • Increased honey production and quality • Conserved Kaya forest and Arabuko Sokoke Forest • Easy to manage
Social, environmental, policy and market conditions necessary	Inter-sectoral acceptance by policy makers and local communities
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 3500 (USD 35)/ hive
Estimated returns	With 10 hives @ 2,500 costing KES 25000, one hive produces an average of 12 kg raw honey harvested twice yields 24 kg Therefore 10 hives yield 10 x 24 = 240 kg x KES 600 per kg processed equals KES 144,000 per year
Gender issues and concerns in development, dissemination adoption and scaling up	- Beekeeping in Kenya is generally a man's job. Change of attitude has led to more youth and women getting more actively involved in apiary establishment, honey processing and marketing. - Has no gender bias
Gender related opportunities	Has equal opportunities for both gender
VMG issues and concerns in development, dissemination adoption and scaling up	Vulnerable and marginalized communities can adopt bee keeping through the available networks in their County Governments, NGOs and NARs
VMG related opportunities	Income generation from hive products and creation of jobs along the value chain
Success stories from similar previous projects	Embraced by Arabuko Sokoke beekeepers in Malindi . Environment has been conserved.

Application guidelines for users	Guidelines and briefs available from the previous work
F: Status of TIMP readiness (1-ready for up scaling; 2-requires validation; 3-requires further research)	Ready for up scaling
G. Contacts	
Contacts	Director, KALRO ARI Marigat
Lead organization and scientists	NMK, Mary Gikungu Remy Tuey and Richard Kimitei (KALRO)
Partner organizations	NGOs, Egerton University

Research Gaps

1. Determination of honey botanical origin: Problems and issues in the study sites

Annex 1: Hive types and beekeeping accessories



Kapkuikui super log hive



Langstroth hive



Kenya Top Bar hive (KTBH)



Bee protective clothing



Smoker



IMPROVED KTBH