Development of Beekeeping in Developing Countries and Practical Procedures
– Case Study in Africa –

JAICAF
Japan Association for International Collaboration of Agriculture and Forestry

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Introduction

In our project of establishment of basic information base for the assistance of developing countries, the research study program for this year was devoted to exploring the potential of beekeeping in Africa. We present this document as a report summarizing the information acquired through the studies made in Japan as well as the field surveys carried out in Africa.

The term beekeeping reminds us of “honey” but it represents only a part of great potential that honey bees can create.

Honey bees produce valuable products including honey without competing with other activities of agriculture and forestry. Moreover, as an insect pollinating efficiently the flowering plants, they pollinate vegetables and trees, playing an important role in promoting agriculture and forestry.

As readers follow the contents of this report, they will be able to understand that beekeeping holds a great potential to contribute to poverty reduction and environmental protection including forest conservation.

In preparing this report, we have been much privileged to receive information from many persons in various areas ranging from Kenyan scientists to those engaged in business. Consequently, the document contains several duplications and discrepancies among different chapters. Readers may find certain parts perplexing but the divergences occur due to different positions of writers. We have not dared to unify those differences in observations. This policy has been based on the belief that it is desirable to provide readers with multiple views as alternative solutions that could be applied selectively in effective endeavors by readers when they shall be engaged in actual development programs in the future.

Only, this report takes up the potential of beeswax as one of the conclusions. We would be very happy if the proposition can serve as a reference to readers.

It is our most earnest hope that this report shall be utilized to the advantage of many of those who try to develop agriculture and rural areas in developing countries, and eventually be able to contribute to the improvement of life of local people.

We would like to express our utmost appreciation for those having contributed articles, and personnel of various organizations having provided assistance in carrying out the field surveys, namely, agencies of the Republic of Kenya, diplomatic establishments abroad, headquarters and Kenyan office of JICA, Nairobi office of JETRO.

Finally, I would like to mention that this report has been prepared solely under the responsibility of this association, and does not represent any views of the Japanese government or the Ministry of Agriculture, Forestry and Fisheries.

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Chapter 1 Apiculture

Apiculture is an activity in which man rears honey bees and acquires their products. So long as a honey bee is an animal, the apiculture is generally treated as a form of animal husbandry in a broader sense of the word, and consequently in many countries and regions it is supervised specifically by the administrative structure which controls livestock industry within the larger sector of agriculture. However, when honey bees are exploited as wild living things inhabiting forests, or when they are principally used for pollinating horticultural crops, the agency in charge of the forest management or that supervising horticultural affaires may become the administrative entity for controlling the matters of honey bees. Moreover, when the apiculture is taken up as strategic element in rural development programs, an agency in charge of development, on its own or in collaboration with agencies associated with agriculture, may promote beekeeping. Thus the existence of various possible ways of approaching the development of apiculture that are different depending on what the honey bees are taken for or what is expected of them, is a characteristic of the apiculture.

When we talk about honey bees, we generally refer to a particular species, European honey bees, *Apis mellifera*. Even if they are collectively called under the common name of European honey bees, the products they produce, particularly the propolis (or bee glue) the quality of which depends greatly on source plants, vary widely, being greatly influenced by the vegetation of a particular locality, and hence cannot be considered to be the same to one another. It is a matter of fact that, because the honey produced by the European honey bees introduced into the tropics in general possesses properties different from those of products from other regions, it is difficult to treat the honeys from various parts of the tropics as a uniform product. Furthermore, when the bees are looked at from the viewpoint of extension of apiculture, because, considering the requirement of sustainability, the utilization of bees as a regional resource is often regarded as the fundamental project element, different regions of the world adopt different subspecies of *Apis* as those utilizable in apiaries: African subspecies of European honey bee, *Apis mellifera* (counting up to 10 subspecies) in Africa; subspecies of domesticated Eastern honey bee, *Apis cerana,* (4 subspecies) in Asian countries. From this

context, there emerge two distinct views as to the handling of honey bee products in the international market: the one to advocate the unification of the definition of honey, and the other to be affirmative of the differences among regions and due to species of honey bees.

1) Stages of domestication

Furthermore, there are various stages in beekeeping. Human experience of beekeeping started from the earliest times in which presumably the honey bees coming to existence 5 million years ago were already the object of exploitation for their product by the ancestors of mankind who appeared 1.8 million years ago, in a manner similar to the one by which chimpanzees today lick honey off tree twigs by inserting them into wild bee hives. Later development with higher levels of technology by putting the honey in containers for transportation and storage would eventually complete the so-called honey-hunting. From evidences such as rock paintings of the Stone Age caves depicting honey hunting, it is certain that such types of honey hunting were in those days practiced widely across the Old World where honey bees were distributed. The development of tools and techniques for honey hunting has continued since then and the honey hunting itself is still practiced nowadays principally for collecting the honey produced by the Giant honey bee, *A. dorsata*, (distributed widely from Southeast Asia to South Asia) which is capable of producing a large quantity of honey. The products delivered by honey hunting include honey, beeswax, and larvae and pupae of honey bee, commonly called “infant bees”. Because the honey is extracted more often by crushing entire honeycombs taken out from hives, generally the product quality is inferior. Since honey bees run away from hives (depending on the methods used, they may be exterminated), the same hives cannot be reused. Consequently, nowadays the honey hunting is considered to be the most critical factor to reduce the local populations of honey bees, and therefore in many regions more often than not the activity is controlled except for the case where it is practiced for ecotourism purposes.

The human race is believed to have settled down about ten thousand years

ago when presumably it started to invent the methods to ensure the harvest of honey to a certain extent. Actually the records on the ancient Egypt show that the so-called traditional beekeeping originated there, and based on this the date of the first domestication of honey bees has been assumed to be around 5,000 years ago. However, at that time, apiaries had already been established in the form where a cluster of a large number of cylindrical beehives constructed of clay was laid out on a specific lot. The similar devices were widely distributed across the Middle and Near East.

The type of traditional beekeeping that is still today found remaining in many parts of the world and had preceded the above-mentioned type with a cluster of artificial beehives is considered for a certainty to have been practiced since the times going well further back into the human history. In this respect, the traditional beekeeping practice using hollow log beehives currently found widely in Africa is considered to belong to a more ancient class among traditional beekeeping techniques, although no evidence as record exists to prove it.

Such practice of utilization of traditional beehives consists of processes of firstly waiting for the arrival of a migrant colony followed by the destruction of the hive after the elapse of a certain period to extract the honey. The products are similar to those obtained by honey hunting. Only, because the target honey bee species is one which essentially gathers propolis, it also has been counted since early as one of the products. Actually there are traces which suggest that propolis was used in the embalming of Egyptian mummies.

The utilization of traditional beehives enables a large number of honey bees to establish their habitat in close proximity to the living environment of humans, which would stabilize the honey production commensurate with expectation to a certain extent.

The beekeeping using traditional beehives also continues to be practiced even at the present time, and diverse types of beehives exist not only in Africa but also throughout the world. Since traditional types of beekeeping concentrate honey bees in the areas close to human living environment, we may be able to suppose that they possess also the effect to promote the utilization of honey bees for the purpose

of pollinating agricultural crops on arable lands. However, the significance in this sense is rarely appreciated, and honey bees are essentially deemed as the means of producing honey. Among cases of traditional beekeeping, particularly in the areas where it is difficult to acquire honey bee populations, the improvement of harvesting methods allowing the reutilization of bee colonies is in progress, and the effort can be interpreted as the factor creating a situation in which honey bee colonies with a high density are present close to humans and, albeit indirectly, serving to facilitate the pollination of crops. At this stage, the beekeeping may not be considered to have reached the level of domestication, but it still represents a condition where human race is utilizing honey bees in a more efficient manner.

2) Arrival of modern apiculture

The modern beekeeping, the basic system of which emerged about 200 years ago, was perfected to assume a form resembling that of present-day in North America where the European honey bee was being reared by immigrants from Europe. In Africa which was supposed to have the longest history of traditional beekeeping, the honey hunting and the beekeeping making use of traditional beehives were maintained, and no innovation by modern technology had appeared. The fundamental concept of modern apiculture is the reutilization of bee colonies for which it was called for to develop a method of honey harvesting with a lesser load on them. European honey bees construct a beehive consisting of multiple honeycombs within a closed cavity where they rear brood in the central part and store honey in the fringe portion. In the traditional beehives of hollow log, since honey is stored in the upper part and brood is kept below it, the attempt to collect honey necessarily leads to the loss of brood. Moreover, because the entire beehive is taken out and crushed to extract honey, bees have to start anew by rebuilding combs. In modern beekeeping, a beehive consists of two stages, which enables the use of the principle that the lower stage is devoted for rearing brood (brood-box) and the upper one for storing honey (honey-super). Moreover, by the arrangement that the comb frames in the upper stage are made in a smaller size and thanks to the adoption of “separation” of honey by means of a centrifuge, the emptied honeycombs can be easily returned to bees, thus enabling to minimize the impact due to honey

extraction. Only, while the traditional beekeeping always produces beeswax as a byproduct of honey harvesting, in the modern system no byproducts other than honey cannot be obtained in an ordinary process of honey extraction.

The structure of beehives allowing the inspection and management of multiple frames of honeycomb individually has enabled beekeepers to carry out various management tasks including division of a colony, addition of empty frames for harvesting honey or inversely thinning out surplus frames to build a more compact colony. Thanks also to this structure of beehives the trading of live honey bees themselves has become possible, and the beehives of a standardized size are easily mounted on transportation vehicles, allowing the movement of bee colonies for purposes other than honey harvesting, for instance, the conveyance of colonies exclusively used for pollination to the vicinity of target crops. In short, modern beehives currently in use are very versatile in their function from the viewpoint of efficient utilization of honey bees.

Consequently, beekeepers are using a type of beehives that represents a kind of the greatest common divisor for the majority of beekeepers, but it is also recognizable that an individual beekeeper may not be making use of all the functions available on his equipment.

In modern beekeeping the honey has become a product easily to be harvested whenever it is needed, and hence it has become possible to produce a particular kind of honey collected from a specifically targeted source and stored in honeycombs in a short term. Beekeepers have become able to produce a honey bearing a specific flower name, and the honey products have been diversified and the control of their quality has become possible to a certain extent. Similarly the products which are particular but valueless unless they are fresh, like royal jelly, have come to be produced in a great quantity. Regarding propolis, it has become easy to modify the construction of beehives so that it can be produced as the principal product and not as a byproduct. On the other hand, regarding the beeswax, new honeycombs are rarely harvested along with the extraction of honey, and consequently the products derived from aged honeycombs used for a long period predominate the merchandise in markets, causing problems related to quality. Thus the modern beekeeping can be deemed as a technology that, while it's

primary pursuit concerns the production of honey, has evolved also around the efforts to obtain other articles, the secondary and the tertiary products with higher added value.

Moreover, beekeeping for the exclusive purpose of pollination is also practiced and this also essentially falls under the category of modern beekeeping technology which needs the techniques including the division of colonies and the introduction of queen bees. In other words, the modern beekeeping could be identified as a style of beekeeping that can meet the diverse requirements arising from the diversification of objectives of honey bee utilization.

3) Potential of beekeeping

As described in preceding sections, while the beekeeping on its own is an economic activity to produce health-conscious foods, it also can become an indispensable tool in areas trying to increase the capacity of food self-sufficiency, because it can contribute greatly to the increase of food production through the function of pollination of food crops. Although the modern beekeeping technology with high efficiency can meet the needs for the improvement of product quality and for the expansion of market for processed products, and further for the increase of food production, the traditional beekeeping technology also still holds sufficient potential value.

Under such context, even if the level of development may differ among different types of technology, because the presence of honey bees as the fundamental element constitutes the core of all aspects of beekeeping, it is recognized that the beekeeping holds a high potential irrespective of technology system.

In other words, in the promotion of a project of beekeeping the specific objective of which is well defined, a situation may arise that the introduction of beehives of multiple functions or that of modern technology as a system capable of satisfying diverse requirements, by holding up too high an objective, entails a task rather too burdensome. Under such a circumstance, it is very likely that a traditional type of beekeeping based on a traditional technology system may be able

to achieve a considerably great part of the expected results. The present document essentially assumes the situation that efforts will be made to raise the standard of living of rural residents in developing countries or to realize high revenues through the enhancement of product value. In view of such an implication, an intellectual approach should be indispensable to adapt the beekeeping technology of a high level to that of a level actually needed or to that of an acceptable level. When an intermediate technology is sought under a circumstance where already a new advanced technology system has been established, generally a proven system of practical level of the age coming slightly before tends to be chosen and introduced. In the case of beekeeping however, owing to the high adaptability of honey bees, a new type of intermediate technology system can be created, and there are many cases where beekeepers have been successful in constructing various progressive types of intermediate technology system. This kind of situation of the matter could really be said to be the most important potential that the beekeeping possesses.

Chapter 2 Honey bees and beekeeping resources in Africa

2-1 Honeybee races in Africa

A summary of honeybee classification and distribution has been well documented by Hepburn and Radloff (1997). A recent review of *Apis mellifera* shows 22 honeybee races worldwide and 10 valid geographical races in Africa (Engel 1999). Ruttner (1988, 1992), also reported the same number of honeybee races in Africa based on morphometric studies. The races include *Apis mellifera adansonii*, *A. m. scutellata, A. m. littorea, A. m. monticola, A. m. unicolor, A. m. lamarkii, A. m. major, A. m. yementica, A. m. major, A. m. capensis and A. m. intermissa.* These subspecies have been found to have specific behavioral and morphological characteristics (Ruttner & Kauhausen 1984; Hepburn & Radloff 1997). However, the tropical African races form their own group distinguishable by multivariable analysis (Ruttner & Kauhausen 1984).

While as a lot of research on honeybee races has been conducted on behavior, taxonomy and distribution, very little has been done in Africa. The existing information indicates that throughout Africa honeybee races are quite unpredictable in their defensive behavior and this has caused a lot of fear in beekeeping due to the number of deaths reported on people and domestic animals. For example, in Uganda, honeybees at higher altitudes in the western part of the country have been found to be more aggressive than those found in other areas of the country (Corner 1984). Further, a clear correlation has been found between climate and morphometric characters in tropical Africa. This has been shown by bee races in East Africa with striking differences in size across a distance of 250 km between the coast of Indian Ocean and the tropical rain forest of Kilimanjaro. In this region, the smallest race occurs in the hottest areas, and the largest at higher altitude with low temperatures (Ruttner & Kauhausen 1984).

Current studies have revealed lack of homogeneity in races that were initially thought to belong to certain localities. For instance, *intermissa* a northwestern race in Africa has two morphoclusters that have been revealed by multivariate methods of analysis (Lebdi-Grissa *et al.* 1991; Hepburn & Radloff 1997). So the earlier view

that a subspecies or race is based on the recognition of distinct population and should be different from the neighboring populations is still debatable.

The current literature shows evidently that each of the African honeybee sub-species differs morphologically and behaviorally (Hepburn & Radloff 1997) and their variation has some implications for bee-keeping practice. For instance, *A. m. lamarckii* found in lower Nile valley is a small relatively defensive race and has black with yellow abdominal bands while *A. m. intermissa* is found from Libyan Desert to the Atlantic coast. This race is black, produces much propolis and stings readily. The most studied and commonly used race in beekeeping development programmes is *A.m. scutellata.* This race spreads from Ethiopia to South Africa.

In tropical Africa, significant geographical variability in honeybee races is quite evident in spite of lack of physical barriers. According to Fletcher (1978), the mechanism that brings about isolation is the selective adaptation of races of bees to certain biotopes. The variation in African tropical bees therefore show a clear diversification and isolation by ecological factors and the correlation between adaptive characteristics and environmental factors is much more evident in tropical Africa than in other parts of the world. The observed spatial variability between the subspecies enhances preservation of gene pools for beekeeping industry in East Africa. Further, the hybrids or intermediates produced occupy transitional zones reflecting intermediate ecological zones.

1) Natural enemies and pests

Predation and pest infestations are major problems in African beekeeping industry in Africa. The predators include mammals, birds, reptiles, beetles, ants and wasps and flies (Hepburn & Radloff 1997). Among these predators, the honeybudgers (*Mellivora capensis*), honey guide birds (*Indicator indicator*) and different species of ants are the most common. However, the recent reports indicate that man is the most significant predator to honeybees in Africa followed by honeybudgers (Crane 1990). This is because most honey gatherers use crude methods such as use of fire to harvest and extract the honey from natural colonies thus destroying entire colonies.

Further, wax production has been identified as the most destructive action to honeybee nests. Recent reports show that about 1927 colonies are destroyed per metric ton of wax harvested per annum using traditional methods in the natural habitats in Africa (Hepburn & Radloff 1997). Among the insect community, wax moths (*Galleria mellonella and Achroia grisella*) have been found to cause a lot of damage and absconding to African bees (Fletcher 1978). In many areas in sub-Saharan Africa, wax moths have been reported to cause serious comb damage (Corner 1984).

Other harmful bee pests include Varroa mite and unfortunately it has been found in South Africa and Nigeria. The parasitic mite *Tropilaelaps clareae* has been identified as big threat to bees in the tropics. This mite breeds on bee brood and causes considerable damage to the honeybees' colonies especially due to associated virus infections. Some of the Microporidians causing infections in honey bees include: *Nosema apis* and *Nosema ceranae.* The soiled combs are the primary source of infection. The most important bacteria that may cause diseases in honeybees include: opportunistic *Melissococcus pluton* which causes European foul brood and the fatal *Paenibacillus larvae* causing American foul brood. European foul brood is a serious disease of honeybees causing loss of production and some times colonies. Most of these arrive into African countries from imported honey.

While a lot of information has been documented on honeybee pathogens in many countries of the world, very little is known about them in many countries of Africa including East Africa. The general lack of data on honeybee pathogens in Africa is attributed to lack of local expertise (Hepburn & Radloff 1997). In modern beekeeping, wax combs are likely to transmit pathogens as wax combs are shifted between colonies. These pathogens include virus, fungi, protozoa and bacteria.

2) Beekeeping resources

Sound utilization of honeybees for economic development cannot take place in the absence of information and knowledge of important beekeeping resources. Unfortunately, most beekeepers have little information on important basic bee resources as such food plants and water. According to Hepburn & Radloff (1997),

detailed studies of honeybee-plant relationship are still patchy. However, some data exist on important bee plants in Africa e.g. Lobreau-Callen and Viry 1993. Hepburn & Radloff 1995. The best summaries of the most important bee plants have been documented by Crane (1984), and Hepburn & Radloff (1997). Sustainable beekeeping in Africa can only be achieved through understanding and conservation of the most resourceful plants for the bees in terms of nectar, pollen and resin. Knowledge on bee-plants that are important to bees in different localities and seasons is still very scarce. This implies a need for documentation of important plant species through biotic survey and palynological analysis of honey.

The major bee plants in Africa are trees that are also used by local communities for charcoal production and timber. With time most of the resources tree species have been reduced to small populations that cannot sustain the bee colonies. This situation is more prominent in dry land areas where tree species like *Acacia* are utilized by local communities for building and charcoal production. Thus most of the problems encountered in such areas in regard to poor honey production are related to lack of enough food sources and prolonged droughts. With the continuous increase in land pressure due to population growth, less and less land is becoming available for bee forage. The worst hit areas are highly productive arable agricultural areas where land use intensity is high. In such areas, the land is rarely left fallow and it is ever tilled for crop cultivation. On the other hand, large scale farmers in Africa are equally impacting the honeybee bee floral resources negatively. This is due to clearance of large tracts of natural vegetation as well as use of chemicals such pesticides and herbicides.

Because of current threats to bee flora, the beekeepers in Africa have to come up with alternative measures to conserve the important bee-plants within their farms and in the surrounding natural habitats. The beekeepers should be encouraged to plant multipurpose tree species that are not only nectar and pollen sources but also good trees in terms of timber and of medicinal value. While a lot emphasis has been put on woody species, the role of herbs and shrubs remains poorly understood and appreciated by most beekeepers in Africa. Most of these herbs are multipurpose and flower throughout the year. For example, the genus *Leucas* is widespread in Africa and flowers early in the growing season (Ngethe

1984). Example plants of species in this genus include *Leucas glabrata*, *L. micrantha* and *L. pododiskos*. Several other plant species in the family Labiatae are traditionally used to scent new hives and attract swarms e.g. *Ocimum kilimanscharicum* and *Plectranthus* species.

In the dry areas, most of the bee plants such as *Grewia* spp die off during the dry season but local communities should be encouraged to conserve drought resistant plants such as *Acacia* spp and *Sanseviera* spp. In such areas honey production is best produced by bee races that have the ability to utilize the short lived resources followed by migration to richer areas in term of food. However, with careful management of local colonies the degree of absconding and migration can be minimized. In order to increase understanding and conservation of the most important bee flora, the following activities should be undertaken:

- Establishment of inventories of the most important bee plants in different localities. This information can be acquired using combined effort of field surveys and interviewing beekeepers using structured questionnaires.
- Establishment of nurseries of the most important plant species in ecological zone
- Publication of local guides, CDs and pamphlets on most important plants species to bees.
- Publication of local floral calendars for each ecological zone. They can be presented in both English and in local languages.
- Botanical maps showing the distribution of most important plant species.
- Preservation of natural habitats including riparian vegetation along rivers and roadsides.
- Planting of permanent bee forage either annuals or perennials designed to attract bees over many weeks or months. Candidate bee pasture plants should be rich in nectar and pollen, easy to grow, cost-effective, non-invasive, long- blooming, and not bloom at the same time with crops in order avoid competition for pollinators.

- Management of pasture land for bees
- Capacity building on identification of bee flora and other important resources such as resin providing plants.

Proper management of pasture land can also promote proliferation of local bee plants. The older the pasture, the more likely it is to have suitable plant species. This means it is best to keep pastures more-or-less permanent. Temporary pastures, such as those grown in crop rotation, have very low plant diversity even though the cover crop (as sweet potato) may be a rich bee resource during the dry season (Gikungu 2006). It is important to not allow overgrazing because it promotes invasion of fast-growing grasses that crowd out nectar-yielding herbaceous plants.

In planning a bee pasture, beekeepers may choose a collection of plants that produce an unbroken succession of bloom throughout the season. Local beekeepers, extension agents, and horticulturists are good sources of information about the important bee plants in an area and their historic bloom times. Despite the fact that some annuals provide quick and relatively abundant bee forage, perennial herbs and shrubs are superior bee forage plants and deserve special attention by beekeepers as well as conservationists. Compared to annuals, perennials are generally richer nectar sources. Because of their longevity, perennials provide bee populations a more-or-less dependable food source year after year. This partly explains why the number of plant species is high in undisturbed habitats.

Holistic conservation and management of bee flora therefore requires management of suitable habitats. Bees prefer thrive best in open, sunny habitats with an abundance and diversity of flowering food plants rather than in flower-poor, shaded woodlands (Gikungu 2006). Open habitats rich in native flora attract more bees because honeybees are floral density dependent. Undisturbed areas offer rich floral patches for the bees although studies have shown that honeybees survive in persistent manner in disturbed sites as well. However, heavily wooded areas in the forest ecosystem are not always suitable for the honeybees although the bees are able to forage on high canopies. The only exception is those areas with nectar-producing understory and margin plants such as *Polia condensata, Justicia*

flava and *Desmodium* species that are found in tropical rain forests of Africa. Induced opening of canopies in selected portions of African tropical forests is necessary for increased diversity and density of important bee-plants which also support the non-social bees. Other important plant species that are so important to the bees along the forest edges include Impatiens spp, *Caesalpinea decapetala* and *Leucus* species (Gikungu 2006).

Other important beekeeping resources that are still missing in many African countries include the following:

- Equipments, smokers, extractors, stainless storage containers, etc.
- Trained extension officers in beekeeping
- Books and training manuals for beginners and trainers of trainer (TOT)
- Field guide of bee plants including honey-dew producing plants
- Floral calendars of different eco-regions
- Migratory beekeeping policies and apiary regulations
- Rules and regulations on pesticides
- Apiary inspection services
- Checklist of authorized queen breeders. So far the well known commercial queen breeders are found in Kenya, South Africa, Morocco, Libya and Egypt.
- Infrastructure and honey collecting centers or market places with proper storage facilities
- Websites
- Increased regional beekeeping colleges

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A list of common bee plants in tropical Africa

Acacia mellifera	*Acacia albida*
Acacia dudgeoni	*Acacia gourmaensis*
Acacia Senegal	*Acacia nilotica*
Acacia polyacantha	*Acacia tortilis*
Acanthus pubescens	*Achrospernum scimperi*
Adansonia digitata	*Ageratum conyzoides*
Albizzia lebeck	*Anacardium excelsum*
Anacardium occidentale	*Annona senelalensis*
Anogeiss leiocarpus	*Asparagus officinalis*
Aspilia mossambicensis	*Asystasia gangetica*
Avicennia marina	*Azadirachta indica*
Begonia meyeri-johannis	*Bidens pilosa*

Botriocline amplifolia
Botriocline fusca
Brachystegia bentham
Brachystegia spiciformis
Caesalpinia decapitate
Carica papaya
Cassia(Senna) siamea
Ceiba pentandra
Chaemaecrista hildebrandtii
Citrus aurantium
Citrus bergamia
Citrus deliciosa
Citrus grandis
Citrus limon
Citrus medica
Citrus paradici
Citrus reticulate
Citrus sinensis
Cocos nucifera
Coffea arabica
Coffea eugeniodes
Cola nitida
Commelina africana
Combretum spp
Combretum paniculatum
Cucurbita maxima
Crassocephalum muotusum
Crassocephalum crepidiodes
Crassocephalum vitellinum
Crotalia brevidens
Croton megalocarpus
Croton macrostachyus
Dalbergia sissoo
Desmodium spp
Dialium elgleranum(excelsum)
Digitaria scabra
Diospyros batocana
Diospyros mespiliformis
Diospyros virginiana
Durio zibethinus
Dyschoriste radicans
Desmodium spp
Dombeya torrida
Dombeya burgissiae
Ehretia acuminate
Elaeis guineensis
Emilia discifolia
Eragrostis tenuifolia
Eriobotrya japonica
Eucalyptus alba
Eucalptus albens
Eucalyptus cadambae
Eucalyptus camaldulensis
Eucalyptus citriodora
Eucalyptus cladocalyx
Eucalyptus maculata
Eucalyptus melliodora
Eucalyptus paniculata
Eucalyptus robusta
Eucalyptus saligna
Eucalyptus torrelliana
Eucalyptus tereticornis
Euphoria longana
Butyrospermum parkii
Galinsoga parviflora
Geniosporum rotundifolium

Gleditsia triacanthos *Gliridia sepium*

Gmelina arborea *Gossypium hirsutum*

Grevillea robusta *Grewia mollis*

Guizotia spp

Cleome gynandra (Gynandropsis gynandra)

Harungana madagascariensis *Haematoxylon campechianum*

Helianthus annuus *Hibiscus spp*

Hymenae stilbocarpa *Hypoestes solant*

Hypoestes trifolia *Impatiens batoni*

Impatients glandulifera (Himalayan Balsam)

Inga edulis (vera) *Ipomoea batata*

Ipomoea wightii *Julbernardia globiflora*

Justicia flava *Justicia striata*

Khaya senegalensis *Kyllinga spp*

Maesa lanceolata *Madhuca longifolia*

Mangifera indica *Melicoccus bijugatus*

Melicoccus lepidopetalus *Mimusops elengi*

Moringa oleifera *Musa spp*

Nepeta spp *Nephelium lappaceum*

Nephelium litchi (Litchi chinensis) *Nyssa ogeche*

Ocimum kilimandischaricum *Ocimum gratissium*

Parkia bicolor *Parkia biglobosa*

Parkia clappertoniana *Parkinsonia aculeata*

Pavonia urens *Passiflora endulis*

Persea america *Phaseolus vulgaris*

Phaseolus aureus *Pithecellobium ducle*

Plectranthus edulis *Plectranthus sylvestris*

Plectranthus parvus *Plectranthus laxiflorus*

Plectranthus albus *Plectranthus assurgen*

Pongamia pinnata *Prosopis juliflora*

Prosopis cineraria *Prosopis glandulosa*

Prosopis pallida *Prosopis pubescens*

Protea spp *Psidium guajava*

Pterocarya erinacea
Racinus cummunis
Roystonea regia
Schinus terebinthinfolius
Sesamum indicum
Spondias mombin
Syzygium cordatum
Syzygium jambos
Terminaria ivorensis
Tithonia diversifolia
Trifolium spp
Vaccinium spp
Vernonia lasiopus
Vitex agnus-castus
Zea mays
Zizyphus Mauritania
Zizyphus spina-christii
Rhamnidium glabrum
Robinia pseudacacia
Salix spp
Sclerocarya birrea subsp. caffra
Spathodea campanulata
Syzygium aromaticum
Syzygium cuminti
Tamarindus indica
Terminaria superba
Toona ciliata
Urena lobata
Vernonia amplifolia
Vernonia syringiforia
Vitex doniana
Zehneria scabra
Zizyphus mucronata

Chapter 3 Beekeeping in Kenya

3-1 Natural conditions and agriculture and forestry in Kenya

3-1-1 Natural conditions and the present state of land use

Kenya has a land area of 569,249 km^2 which is 1.5 times as large as that of Japan and a population of 37million people is living there (2007).

17% of the land area is covered by the areas suitable for agricultural production with an annual rainfall of more than 850 mm. These areas are situated at an elevation higher than 1500 m where about 70 % of the people live. Most people are engaged in cultivation of food crops (maize, wheat, potato, beans) and dairy farming. These areas include forested land which occupies 2.4 % of the national land. In particular, those areas with an annual rainfall exceeding 1,200 mm, occupying 12 % of the national land, are fertile and cultivated with export crops including tea, coffee, pyrethrum, vegetables, and flowers. These crops are cultivated not only on farms of smallholders, but also on large-scale farms handed over from former white plantation owners.

32% of the national land is covered with the areas called semi-arid zone with an annual rainfall ranging from 610 mm to 850 mm. In the semi-arid zone, subsistence cultivation of such crops as maize, millet, sorghum, and beans is practiced. In addition to crop production, animal husbandry rearing cattle, goat, and sheep is playing an important role from the viewpoint of asset. Moreover, shrubs are utilized as firewood or for charcoal making. In semi-arid zone, about 20 % of people live.

50 % of national land is covered with the areas called arid zone with an annual rainfall of less than 610 mm where because of low rainfall with irregular occurrences, agriculture is difficult to practice and hence animal husbandry by

nomadism is practiced. About 10 % of people live in this zone. Since 1970, Kenyan government has tried actively to develop the arid and semiarid zones which have difficult climatic conditions and also a population afflicted with poverty, calling them ASAL (Arid and semi-arid lands), but the reality shows that little significant success has been achieved so far in this regard.

The agricultural land area under irrigation is about 100,000 ha, accounting for only 3.5 % of the total arable land area of 3 million ha, and because the agriculture is mostly practiced under rainfed conditions, the reduction of production is remarkable in drought years. In irrigated lands, vegetables and flowers for export, rice, coffee, citrus fruits, maize, cotton and banana are cultivated.

As described above, Kenya consists of several ecological areas under natural conditions of rich diversity ranging from arid zone to wet temperate zone.

3-1-2 Current status of agriculture

The agricultural structure in which commodities including coffee, tea, pyrethrum and sisal occupy the leading position in production has not changed in the past 5 years. Despite certain degrees of fluctuation in production due to occasional droughts, the overall tendency during the past 10 years has not changed. However the situation still persists that the domestic production of essential food crops such as wheat, rice, maize and sugar cannot meet the demand and the deficits have to be balanced by import.

On the other hand, if one looks at the trend of export in the past 10 years, one notices that the exports of horticultural crops like cut flowers or vegetables have increased rapidly and taken over the top position previously occupied by traditional export crops of Kenya like coffee and tea. In 2007 in terms of monetary value as well horticultural crops became the top export crops. These principal export crops, coffee, tea, cut flowers and vegetables, are grown on fertile arable lands located in the areas with an annual rainfall exceeding 1200 mm and at elevation higher than

1500 m. In the arid and semi-arid areas however, farmers principally grows crops consumed at home and hence presenting few opportunities for earning cash income, which tends to create the situation that the economic disparity is expanding between agriculturally fit areas and arid/semi-arid areas.

3-1-3 Status of livelihood in semi-arid areas

This section shall analyze the social circumstances in districts of Mbeere District and Tharaka District situated in semi-arid land based on the "Report of preliminary study and evaluation on Intensified Social Forestry Project in Semi-arid Areas in Kenya", and furthermore shall try to reconstruct the status of livelihood of people in semi-arid areas, as a target population of beekeeping development, based on the report of a survey conducted in Kwavonza Division of Kitui District, "Sustainable Tree-Growing : A case study of Kwavonza,1997".

Because the land is often exposed to droughts, agricultural productivity is unstable, making it difficult for farm households to secure foods solely from self-sustenance production.

Generally speaking, rural households in semi-arid regions have a family consisting of 7 to 9 persons, owning land of from 4 ha to 8 ha, out of which 2 to 3 ha of land is cultivated to acquire food essentially for home consumption such as maize, beans, cowpea, pigeon pea, green gram, sorghum and millets, and remaining lots are used as pastures or bushes for collecting firewood and for grazing livestock, i.e., cattle, sheep, goat, etc., as asset for emergency purposes. However, since the means of earning cash income are lacking, although people try to raise income by fabricating and selling products including ropes and baskets braided from sisal hemp, tree seedlings, charcoal, firewood, honey, by exploiting resources found in the environment, the cash income is not sufficient. Consequently, it is a reality that, for the portion of 80 % of cash income, they have to depend on wages earned during agricultural off-seasons, remittance from children, and wages of work away from home. The current situation in semi-arid regions could be summarized that because

the production of agricultural crops is greatly affected by the impact of droughts, the livelihood is unstable, and furthermore since the cash income is limited, people are obliged to endure the livelihood of the lowest limit. Therefore, this ecological zone can be identified as the very region where promising sources of earning income including beekeeping are urgently being sought after.

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3-2 Current status and historical aspects of Kenya's beekeeping

3-2-1 History of beekeeping in Kenya

There are over 20,000 species of bees in the world all of which belong to the superfamily Apoidea. Most of them lead solitary lives. A few bees however are social, leading a community life in a colony (Jones 1999). Social bees make honey which is their food store but Apinae (honey bees) and Meliponinae (stingless bees) are the only two sub-families that produce more than they need, making it worthwhile to keep them for honey production. Apis is furthermore the only genus in the Apinae subfamily among whose species *Apis mellifera* is of greatest economic importance. The two dominant African races of *A. mellifera* are *A. m. scutellata* in East Africa from Ethiopia to Southern Africa and *A. m. adansonii* which predominates in West Africa. Both species are smaller compared to the European honey bee and their colonies produce more swarms.

As in many other countries in the world where honey bees (*A. mellifera*) naturally occur, some Kenyan communities have had a long history of harvesting honey from the wild or in traditionally managed colonies. The most well known of these communities include those living in and around key forests found on Mt. Elgon, Mt. Kenya, Aberdare ranges and Mau Escarpment. Others live in the plains as pastoralists and gather honey from extensive woodlands. Honey has always been the most important hive product in all cases. By 1982, the tropics produced 13% of honey in the world market, the subtropics 30%, mostly from Argentina, China and Mexico while temperate regions produced 57% (Bradbear, 1985).

1) Attempts at modernization

The beekeeping industry in Kenya first received the attention of the British colonial government in 1950s (Min. of Agriculture 1967). A memorandum was signed then for the development of the bee industry, establishing the position of a

full-time bee officer and instructors. Four key outputs were expected out of this initiative, namely:

- provision of marketing facilities particularly in areas where trade in bee products was not already properly developed
- improvement of quality and total quantity of wax produced
- introduction of more suitable equipment to modernise operations, including double chamber hives and fireless smokers to reduce fire risks, thereby minimizing fatalities of bees when harvesting honey and increasing honey quality
- development of honey refineries for extraction

3-2-2 Demand and supply of bee products in Kenya

From the start, it was apparent that any large scale development of the beekeeping industry would depend on sales to the beer industry. Limited markets existed for refined honey which sold at higher prices and helped to offset cooperative overheads. Another opportunity that was to be explored was the marketing of Kenyan honey abroad for its strong flavor, a characteristic European consumers found attractive. The local beer hall trader extracted wax as a byproduct of making the drink and was not inclined to use pure honey in the process as he made even higher profit margins by blending honey with sugar. For this reason he made great profit margins and discarded the wax as waste.

The possibility was explored to increase honey production by working with master growers. In this scheme, individuals with no previous bee keeping experience were encouraged to start doing so and then sell their honey directly to agents or shops in urban centres. They were further expected to contract other

producers in their neighborhoods who would supply them with additional honey, further stimulating growth in the industry. The plans of the colonial government were to encourage production of honey locally to the extent that would make it unnecessary to import it.

Initially, two refineries were set up at Makueni and Tharaka (Marimanti) as pilot sites from where success would be duplicated at the Coast, in Baringo and Samburu. Refineries paid cash for honey and sold it to village shops and beer halls in Nairobi. By the late 1950s, new problems began to present themselves, mostly in mismanagement of the honey processing plants and beeswax cooperatives. Operations came to a halt in most of these concerns by 1960. Wamba refinery closed in 1964. In spite of all these misfortunes, these efforts proved that a sufficient amount of honey could be produced and exports of beeswax increased to a new level. Consideration was given to establishing a bee keeping section in the Ministry of Agriculture along lines of what was happening in neighboring Tanzania.

Based on an estimate that the industry was worth close to one million sterling pounds, OXFAM granted Kenya 8000 sterling pounds as external assistance through Freedom from Hunger. This was to facilitate a pilot project to assess what could be done to develop the bee industry further over a period of two years (Min. of Agriculture 1967). It would support construction of a laboratory to facilitate quality testing of samples of wax and honey. A larger project would be considered if the pilot phase proved worthwhile.

To harmonize the quality of hive products in Kenya, standards have been set at national level for table honey (KS 05 – 344) and beeswax (KS 05 – 1279) that are intended to guide beekeepers on the permissible harvesting and processing procedures to follow (Odwori and Aleke, 1997). These standards not only demand that honey be graded by undertaking technical tests at the source but also insist that only plastic or stainless steel containers should be used for storage. Quality standards are nevertheless a new concept for traditional beekeepers who normally deal in crude honey. Much of what they produce is absorbed by a beer industry for which pollen and brood, technically regarded as impurities in honey, give added value to the brewing process (Min. of Agric., 1967; Vorwohl, 1976; Clauss and Zimba 1989). Quality standards are therefore for the benefit of those who wish to penetrate

external and export markets in which quality of a different nature is strictly enforced. Concerned about the fate of honey produced in Africa for trade on the world market, Wix (1989) and Wainright (1989) have suggested practical ways to produce good quality honey, which include educating beekeepers on the types of combs to harvest and improved processing methods to follow.

1) Marketing of beehive products

OXFAM spent much time and effort in developing better markets for hive products in Kenya. Industry was encouraged to use local wax and refineries were set up in several districts, packing and distributing brands of local honey. Exports of honey to the United Kingdom and Europe were investigated but not found promising. Kenyan bees wax was found easy to bleach and had good prospects for substituting imports. By 1959, honey refining plants were established at Makueni, Gorgor, Kakamega, Wamba and Kitui. Cooperatives trading in beeswax existed in Taveta, Kipsigis and Makueni. In Elgeyo-Marakwet, Baringo and West Sute County Councils beeswax industries were established while small wax refining plants were already set up in Kabarnet, Kapenguria and Eldama Ravine. At the expiry of the OXFAM exploratory project in 1970, the Government of Kenya requested for technical assistabnce from the Canadian Government to help set up a bee keeping section in the Ministry of Agriculture (Kigatiira, 1979).

The Tanzania model after which the Kenya industry was to be molded guaranteed cash for the purchase of honey and beeswax from the village producer. The state also controlled the international markets and further guaranteed financial stability of the commodity market and the cooperatives. Once the structure existed to finance the programme at the village level the potential to speed development was enhanced by:

- improvement of harvesting techniques from traditional beekeeping and stimulation of crop supplementation from wild colonies as well as increasing interest in modern frame methods.

- those beekeepers showing the most promise were provided with extension services with instruction provided at the village level while the most keen were routed to beekeeping institutes for periods of full time education.
- a few of the farmers already possessing a diploma certificate were selected for attachments in the UK for highly selective areas of work of a special nature.

This programme attempted to provide experience that was not readily obtainable in Tanzania so that improved methods for handling and processing bee products would not only be stimulated but the potential to develop modern systems of operation of a more commercial nature would be enhanced (Wix and Lyatuu, 1981).

3-2-3 Beekeeping practices and equipment in Kenya

In the most basic traditional set up, honey gatherers endured much stinging as they robbed bees of their honey in the wild. They usually did so at night and used live torches as smokers, working hurriedly and without protective clothing. The result was that they burnt and killed many bees in the process and there was always danger of setting vegetation on fire in this quest for honey. By the stage when hives were introduced, they were simply made from a hollow log, bark or clay. The hive was not destroyed during harvesting but the equipment used in harvesting honey was just as in robbing. The crude product of comb and honey crushed together was mostly consumed as food or fermented into a traditional beer. In this scenario, all wax was lost (FAO, 1986).

This was the situation in Kenya by the time a Canadian funded beekeeping project was initiated in 1971. There was little or no table honey in local shop outlets except that which was imported from Australia. Most of the honey produced in East Africa by then was unfit for use on the general markets but was well suited for making beer. The most surprising finding was that this beer industry consumed the bulk of honey at above normal prices. In modernizing operations, it was desirable to

move from this stage to a situation whereby the bee colony would be preserved and not driven off during honey collection.

The Canadian funded project was not keen to drastically change traditional beekeeping directly from log or bark hives to modern hives (Townsend, 1971). Instead, a transitional approach was adopted as this was proven to have worked elsewhere. This project therefore recommended, among other things, training of budding Kenyan apiculturalists locally and in Canada; research on bee habitats, honey flows and honey characteristics; development of intermediate hives and bee houses; selection of more gentle queens and the setting up of honey and wax collection centres in all areas where beekeeping showed promise. To further support the venture, it was recommended to set up demonstration and training centres for every District concerned. The approach taken was to begin the program in two or three best areas, and from the experience gathered, extend to other areas as personnel were trained. Further promotion was to be undertaken in the mass media using radio and by distributing pamphlets widely. This approach proved very successful in Swaziland where beekeeping was popularized through a weekly Home Economics radio programme (Motsa et al. 1989).

Having taken such a decision, the program opted to move the industry forward gradually by building infrastructure, educating men and women and training them; designing equipment and producing it and supporting the beekeeping effort with research. Looking back, there was no better approach to modernization of the bee industry in Kenya than the one taken by this project. Failure or even a serious delay in any of these pre-requisites could have compromised, perhaps irremediably, the future success of the programme. According to FAO (1986), anticipated gains at the end of the first phase of such a project phase would lead to domestication of bees to the extent that colonies could be preserved after honey collection; hives would not be destroyed and the colony would be little disturbed after honey collection; hives could be opened to obtain combs and subsequently re-used; colonies would be available for a following crop after harvesting honey. Only capped honey would be crushed and strained, thereby improving quantity and quality collected. This would in turn produce honey of acceptable standards in village markets while wax would be collected for use or sale. The technical improvement involved in the process was

the design of a hive more rationally conceived than the original one in use. It was however expected that it would take great effort to bring the traditional beekeeper to adopt such a hive since it is never an easy matter to overcome the authority of tradition. Step by step, it would be necessary to demonstrate that family income would increase as a result of adopting by beekeepers of such transitional hives, whose principles are closer to modern rather than traditional hives. An early decision by the project team was to respond to interest expressed by individuals and groups, rather than to sell the programme and its purpose aggressively (Kigatiira, 1979).

1) Modern beekeeping methods

The approach recommended and the principle behind operating a modern hive is to make it possible to move individual combs for inspection or honey collection, then replace them without damage to the colony. It follows the discovery in the 17th century that if rounded bars, baited with honey or beeswax, are placed at the top of a hive whose sides slope inward toward the base, bees do not attach their combs to its sides or bottom. Instead they build comb straight downward from the bars. Such a hive takes between 20 and 33 "movable combs". To keep bees from building unwanted comb between vertical combs, or to the sides of the hive, the spacing of top bars is of primary importance: it must give the correct bee space which is precisely 32mm for tropical *A. mellifera*. In transitional hives which constitute a stage between primitive and modern beekeeping, long top bars provide all the support combs need under normal circumstances. An exception is where hives must be moved, as happens in migratory bee keeping, for then combs may break unless they receive additional support incorporated in the design of the top bar. Such hive equipment is further enhanced with in-built queen excluders that confine the queen bee to a brood area while giving workers access to the hive area beyond. This makes it possible to harvest honey and beeswax by simply removing the combs containing fully capped honey, but no pollen or brood (FAO 1986).

2) The Kenya Top Bar Hive

This transitional wooden hive was developed during the Canadian funded bee project in Kenya in the 1970s and was named the Kenya Top Bar Hive (KTBH). See Fig. 3.

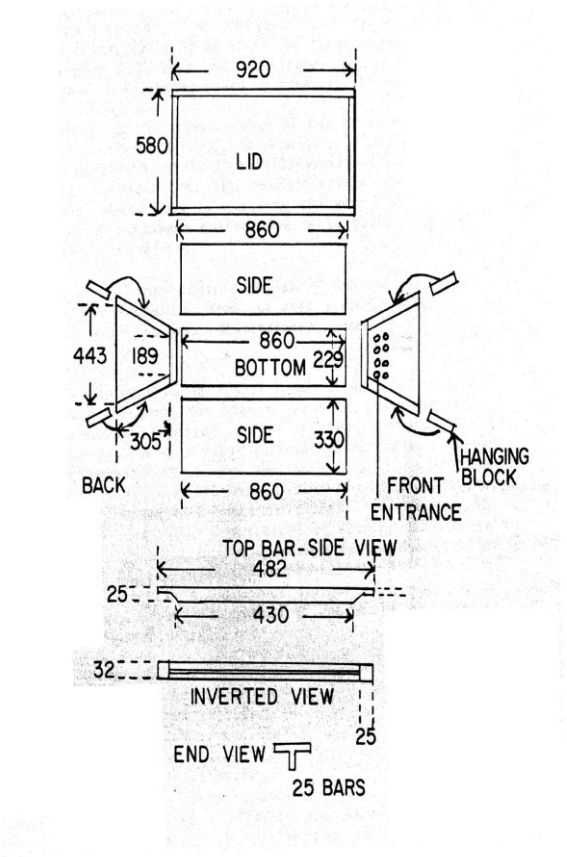

Fig. 3: Dimensions of various parts of the Kenya Top Bar Hive according to original specifications (mm).
Drawing by Stephanie Townsend (FAO 1986).

A queen excluder is placed vertically in the centre of this hive and a feeder, made in the shape of a comb and suspended from a top bar, can be used if required. It is recommended to build the hive out of well seasoned timber so that all parts fit well and the top bars give a complete cover for the hive. At both ends of the hive, a hanging block is fitted about 10 cm from the top to which wires are attached. A

framed iron sheet cover is loosely fitted above the bars to keep out rain. The hive is further protected from ants by applying blobs of grease at intervals along the length of wire. These wires are used to suspend a hive above the ground at a working height of about 1m so that badgers cannot reach it. The best alternative is to suspend the hives from solid poles – at least 150mm (6 inches) in cross section – or from trees. Ten holes are drilled on one of the ends of the hive (at 25 – 35mm above the floor) to give bees entrance while keeping out larger beetles.

3) Best Management Practices for Honey bee Colonies in KTBH

It is recommended that transitional hives are sited a little distance from human dwellings as African bees can be aggressive. The site should be quiet – away from areas where children play or where there is continual noise. Bees need a supply of fresh water, which can be a nearby river, pond or even a dripping tap! The apiary should be kept tidy, with the grass cut short and any stones removed that would cause the beekeeper to stumble while working (Jones 1999).

Top bar hives are best placed near food sources and cash crops that need pollination while observing about 150m between the productive area and the location of hives. This allows people to tend the crops in a manner that does not make bee colonies feel threatened by their presence. Hives need shelter from strong winds and benefit from shade to keep out strong sunlight. To prevent disease outbreaks, marshy locations and land liable to flooding are not suitable sites for placing hives. Humid conditions also prevent honey from maturing and should be avoided. Finally, bees do not do well under conditions where they encounter smoke, fire, vandalism or neighbors who interfere with them.

Beekeepers in the tropics can take advantage of the fact that top-bar hives are relatively cheap and simple to make. This allows them to manage bees in a more efficient way than with traditional fixed-comb hives (Jones 1999). Top bar hives have numerous advantages which include the following:

- Only top bars need to be made to precise dimensions. This means that hives can be made out of relatively cheap local materials and with simple tools.

- The size of the hive can be varied to suit local conditions.
- Every comb is accessible without removing the others. The technique of handling one bar at a time causes less disturbance to the colony and greatly reduces the number of bees flying around while the hive is open.
- The brood can be inspected easily, giving the beekeeper good control over management of the bee colony.
- Honey combs can be inspected regularly in order to determine when they are ready for harvesting without disturbing the brood. The honey that is harvested is usually of high quality as it is capped and not contaminated with brood or pollen.
- Good quality beeswax is obtained.
- It is not necessary to lift any other parts except the top bars and this makes the hive suitable for use by those who cannot lift heavy weights.
- Height at which the hive is suspended can be customized. This places all top bars at the same level which is chosen to suit the individual operating the hive.
- Wires suspend the hive above the ground and away from predators.
- These hives promote, preserve and increase the bee population which in turn benefits the economy through increased pollination, honey and wax production.

4) Basic routines

When a hive is occupied and bees are busy, it is best for a beekeeper to visit in the evening wearing light colored clothes that are protective of the face and eyes. True beekeeping only takes place when some understanding is established of the bee and its ways. This makes it possible to predict behaviour and apply management techniques (Jones 1999).

When working in the apiary, one should be as quiet but also as quick as

possible, using smooth movements and removing only a few bars to create a gap at the empty end of an open hive. This creates a space which is smoked gently before removing and replacing the remaining bars, one at a time. Bars are returned in the same order and bees should not be squashed or they will release a smell that sets other bees on the attack. All top bars should be pushed together as they are replaced and no gap remains as the lid is put back in place. Only a few hives should be worked at a time and one should not remain longer than 45 minutes in an apiary in order not to agitate the colonies.

5) Training in beekeeping

Before doing something right, beekeepers need to observe it done right. This principle of psychomotor learning presupposes that observing is not just seeing, but is a way of looking that must be learned (Mulder 1986). Training beekeepers in modern beekeeping methods requires them to find their own personal style in working with bees. Thus the teacher need not be imitated as long as an objective of training is met. In this way, every participant is given time to acquire their own beekeeping style while identifying themselves with a person who acts the way they want to learn. Beekeeping training, if it is to be effective, best takes the form of vocational education. No wonder traditional beekeepers best learnt it on the job!

Beekeeping training cannot be replicated from one place to another because every country, area and location has different starting points *which* need to be identified in advance (Mulder 1986). The main question must be "is there a need for beekeeping training and if so, who is asking for it?". Once a target group has been constituted, it can be homogeneous or heterogeneous depending on what members have in common. It is not desirable that a group is too heterogeneous, for example, comprised of men and women, literate and semi-illiterate people, children mixed with adults and so on. Other factors to take into consideration are that a group of women might prefer to be under female trainers while the opposite may be true of men. The training planners can decide on the level of homogeneity of the groups they will work with, sometimes splitting a larger group into more homogeneous groups to their advantage, for example, a children's group, an adult group, a group

of people with prior experience with bees, a group of participants with similar level of education, the close vicinity of dwelling places of trainees relative to training venue and existing social structures within or beyond the group. In general, local people train one another more effectively than a foreigner training them. The trainers' or teachers' qualifications are gauged against their level of education, their beekeeping experience and such social qualities as ability to communicate in the local language. One trainer might possess all these qualities but more likely than not, a number of trainers will jointly cover these needs. In this case, activities are split up between the trainers so that one of them is responsible for the educational process while another who is familiar with the social structures takes over the beekeeping activities. Participants may call upon trainers to help them at any time and they need to be willing to do so. Trainers thus might find themselves required to give follow up care after training. They need to be motivated and willing to help participants and to communicate with them beyond the training meetings (Mulder 1986).

This matter of training is discussed here because it has been a bottleneck to modern beekeeping in Kenya since the 1970s. It is therefore time to evaluate the approaches taken in order to determine areas for further improvement. Every trainer and every participant wants to get good results from training. They look forward to a pleasant training experience and optimal learning climate during a course. Every training opportunity therefore needs to be continuously evaluated to know whether it is good or not while in progress and at its conclusion. It is not the number of participants or number of courses that should count but rather, whether training produced successful beekeepers or not.

Gichora (2003) found that beekeepers in Baringo District of Kenya had continued to practice traditional methods of beekeeping despite the introduction of modern beekeeping methods in Kenya nearly thirty years before her study. The Tugen people could count on one another to keep traditional beekeeping practices alive since all of them had either received instruction from a family member or a local beekeeper. It is how they learnt to manage colonies in traditional hives. 92% of 224 beekeepers interviewed had not received any training in modern methods. In exceptional cases, 4.5% of respondents in this household survey had encountered

extension agents of modern beekeeping and learnt to keep bees in modern hives during a short course. The amazing finding was that people exposed to such short courses did not internalize the training and continued to depend on extension agents to manage bee colonies for them afterwards, or else they reverted to traditional management of modern hives!

The poor extension service available to beekeepers in Kenya is characteristic of the developing world where traditional beekeeping remains pre-dominant in spite of the numerous efforts made by governments to modernize the bee industry. To attain the full potential of beekeeping in Kenya, training and more training is still called for in order to convert beekeepers from beekeeping to apiculture. Where possible, true modern apiculture will eventually be attained but in more cases than not, adopting intermediate technology will minimize destruction of colonies at harvest time thereby giving rise to stronger colonies capable of producing more of a better quality honey.

An exposition on beekeeping in Kenya would not be complete without mentioning the need to maximize quantity and quality of hive products by using the most productive bee species and races for our region, the optimum use of bee forage, strict and continuing control of bees and pests, the adoption of satisfactory processing methods and most fundamental of all, research in all these aspects to adapt beekeeping to each ecological zone. Among experts, it calls for humility to accept that no one hive type, bee race, forage variety or management system is ideally suited to all contexts. In particular, the wide variety of climates and vegetation in the tropics and sub-tropics makes it vital to approach each new ecological situation without bias and pre-conceptions (FAO, 1986).

3-2-4 Role of beekeeping in the home and local economy

In Kenya, the local bee race is nomadic and aggressive. The climate can vary widely so bees are found in habitats ranging from forests to deserts. In all situations, bees flourish in areas where there is sufficient pollen, nectar, shelter and water to

fulfil the needs of the colony. They only experience difficulties related to the weather in rainforests where humidity and the rain keep them sheltering most of the time (Jones 1999).

1) Pollination

Bees have co-evolved with plants and they play an important role in crop pollination. Even those plants capable of self-pollination still give better yields if pollinated by insects. Other plants are completely dependent on insect pollination and will not otherwise yield any seed. Pollination by bees is particularly successful because they are consistent foragers that work on one flower type at a time. This characteristic has made bees particularly relevant to modern agriculture, in which vast areas of a crop are grown as monocultures. Where such crops require bee pollination, it is easy to introduce hives in the area, even if it is required to bring them in seasonally only when needed. This means that as modern agriculture takes on a more commercial approach, then honey bees are bound to become even more important and any given area will have a wide capacity to support bees depending on the season. Kenya therefore needs to take advantage of this flexibility of bee colony management and embrace migratory beekeeping as a way of providing pollinators where they are most needed to give good crop harvests.

In the case study of Baringo District of Kenya by Gichora (2003), the pollination services enterprise had not yet taken root in a region where traditional beekeeping was long established. With modernization of agriculture and beekeeping, it is nevertheless an area that holds much promise and into which Kenya beekeepers are encouraged to venture. Farmers can help by selecting and using pesticides with great care and never applying them when flowers are open. Any foraging insects working on open bloom at such a time are killed, unless applications are carefully synchronized to take place when flowers are closed or when there is no wind to drift spray onto other flowering plants or beehives. This is usually early or late in the day. Farmers are also encouraged to manage the landscape in such a way that wild flowers are available to support wild foraging insects when cultivated crops are not flowering. Increasing the planting of

nectar-bearing bushes and trees further supports beekeeping. All these supportive actions will ensure that the hive products derived from bee hives are of acceptable standards and not contaminated with chemicals.

2) Honey production

Honey is a food that requires to be processed and stored in very hygienic conditions. When all is said and done, the Kenyan market operates on a table honey deficit that requires the importation of high quality honey from external sources. This is attributed to the fact that honey is produced mostly for the local market which accepts a mixture of honey, brood and pollen as medicine, a sweetener in the food industry and for beer brewing. Even then, honey is still not available in adequate quantities and it is often sold in an adulterated form by middlemen who wish to stretch their profits.

The standard for pure honey that has been set by the Kenya Bureau of Standards (KEBS) does not accept honey that is contaminated with smoke particles or burnt during processing. To venture into the global market would require producers to adhere to international standards. Furthermore, they would need to supply guaranteed volumes from year to year which may be difficult for an individual farmer to do but is something honey cooperatives can achieve. This takes us back to the model of production promoted by the Canadian Government-funded beekeeping project of the 1970s. Beekeepers therefore have little option but to adopt transitional hives and modern harvesting procedures then take only capped honey combs out of the hive, not those bearing brood and pollen. It further requires equipment in quality processing which increases investment and overall costs of production. Beekeepers can share costs by coming together in cooperatives and selling honey to a common refinery which they have equipped. To give good returns on investment, honey should thus fetch a premium price.

Countries with long established history of modern honey production find there are many ways to present honey to give a variety to consumers. In addition to pure liquid honey, 'honey on the comb' is sold while on a frame or in sections placed in glass jars with extracted honey surrounding the comb. This last combination is

called “chunk honey” and fetches a higher price than conventionally packed liquid honey (Killion 1992). Developing countries like Kenya that promote beekeeping with the main aim being to diversify family income need also to promote other products for which there are no traditional markets, ensuring nothing goes to waste. This is the approach taken by Tanzania where the potential to enhance village beekeeping and stimulate improved methods of handling and processing of bee products is well differentiated from the potential to develop modern systems of operations of a more commercial nature that play a major role in export trade (Wix and Lyatuu 1981). Tanzania has gone further than Kenya to recognize the importance of quality standards of bee products as well as the value of government control of the export market. After production skills have been sharpened, more emphasis is given to developing marketing and business expertise in order to move local products to the global arena.

3) Wax production

In traditional Kenyan beekeeping, honey is the main hive product while wax is at its best, a waste product - spat out by people after chewing the honey comb or discarded by filtering after making beer (Gichora 2003). This situation has not changed much over the last fifty years despite government projects emphasizing the value of beeswax. The low volumes in which it is traded imply that current openings in this commodity lie in the hobby market and that channels have yet to be developed to make it penetrate the industrial market at home and abroad. There are still avenues waiting to be explored in the use of local wax in the cosmetics industry, for making candles for religious services, for making beeswax comb foundation or for waterproofing materials. Minor opportunities lie in its use for making certain adhesives, children’s crayons, candy and chewing gum, inks, and for maintaining musical instruments and sports equipment (Schmidt and Buchmann 1992).

4) Other minor hive products

Kenya does not produce these products at present but there is potential to do

so as modern beekeeping practices evolve into apiculture. See Appendix(P.44).

Jones (1999) lists among these products pollen, which is not stored in excessive quantities by bees, but which can be trapped by a restrictive device placed at the entrance to collect it from foraging workers who return to the hive. Pollen is a nutritional product incorporated in human food supplements to correct unbalanced or deficient diets. It has also been claimed to have curative properties and so is incorporated in traditional medicines and food supplements. Pollen in particular is scientifically proven to be effective in treating prostrate cancer. Environmentalists analyse it to monitor environmental pollution by determining the level of contaminants it contains.

Propolis has been traded by specialists for waterproofing, stopping leaks, as an adhesive, in bow string preparation and as a medicine. Extracts of propolis find their way into the cosmetics and food industry where it is used as a preservative or as anti-fungal additive. It can also be applied to bait hives to attract swarms. Processing propolis is tedious and requires specialized skills to obtain a standard product of controlled quality.

5) More specialist hive products

In a model suggested to rejuvenate the beekeeping industry in Kenya (see Appendix,P.44), Gichora (2003) proposed that all possible hive products should be considered to make beekeeping a viable economic activity in Kenya. This translates into a need for high level training of beekeepers to further exploit their colonies for royal jelly, bee venom and bee brood. The Nairobi-based International Centre for Insect Physiology and Ecology (ICIPE) has demonstrated it is possible!

Queens and package bees would be the ultimate hive product after good management is achieved in colonies nearing their swarming strength. Queens are normally reared to substitute old failing ones and to maintain control of characteristics of a good colony. Package bees are used to care for the queens who are due to be transported to a new destination.

3-2-5 Conclusion

This review of history of beekeeping practices in Kenya confirms that a lot remains to be done to salvage the ailing beekeeping industry from collapse. Fortunately, the Ministry of Livestock is currently meeting stakeholders to gather views that will help to shape policy and guide future direction. I am confident that this effort will yield favorable results, especially if further advice is sought from neighboring countries like Ethiopia and Tanzania who are third world leaders in the trade of hive products. A more vibrant and holistic approach to beekeeping that incorporates practical training of beekeepers will go a long way in lifting the profile of the industry. This will pave way for it to make a higher contribution to the country's economic development, especially from pollination of food and cash crops. Kenya's vision for a middle-income, just and equitable society by 2030 inspires hope that all the infrastructural developments needed to ensure beekeeping are invigorated and thrives will be put in place in the foreseeable future.

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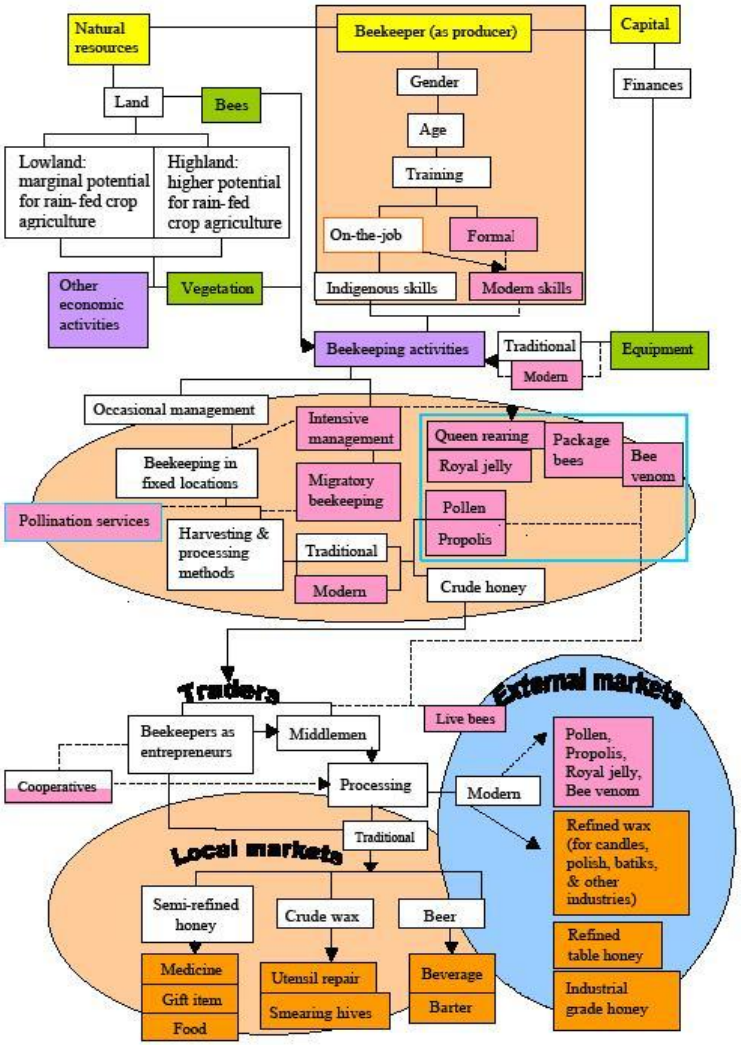

Appendix : A flow chart outlining the current status and proposed future direction for beekeeping in Baringo District, Kenya. It starts at the top by identifying three key factors of production - namely, natural resources, labor (beekeepers as producers) and capital. It portrays how each factor is related to others in the process by highlighting three phases of production – acquisition of skills and equipment, honeybee colony management activities and marketing of hive products. The current situation (white boxes) is shown alongside the un-exploited potential (pink boxes). It is suggested that this potential can be harnessed by intensifying management using movable frame hives and their accessories and by adopting correct handling procedures at harvest time as well as during product processing, packaging, storage and marketing. Research will be necessary to support adoption of technology under prevailing socio-economic and ecological situations.

LEGEND

	Factors of production
	Existing situation on the ground (2001)
	Main inputs for beekeeping
	Economic activities
	Most accessible avenue for training
	Goods and services to be developed
	POTENTIAL YET to be developed
	Beekeepers fully involved
	Beekeepers not involved
	End uses for hive products
→	Direction of input by key components
——	Existing route
- - - - -	Potential route

3-3 Practices of traditional beekeeping – cases observed in district of Kitui- Kamba in Eastern Province of Kenya

For total days of 2 months during the period from June to December 1996, this reporter had an opportunity to study the traditional agricultural systems of Kamba people in the district of Kitui of Eastern Province of Kenya. Since at that time the reporter also studied the practices of traditional beekeeping which provided people with important sources of nutrients and valuable means of earning cash income, the reporter would like to present here the outline.

3-3-1 Practices of traditional beekeeping

1) Procedures to fabricate a beehive cylinder (hollow log)

Normally bee logs take a form of hollow cylinder with dimensions 1 to 1.5 m in length, 25 to 40 cm in outside diameter, and around 3 cm in wall thickness. The length is determined by multiplying a basic approximate measure including the distance between the tip of the middle finger and the elbow of a workman, and the entire length of machete on the market (45 to 70 cm), and adjusted to around 2 to 2.5 times of it. Regarding the outside diameter, there is no fixed rule but it is believed that even a large log cannot be settled by honey bees easily. The tree selected for making bee logs is one of those from which 4 to 5 bee logs can be cut out. As to the shape of material tree, straight bee logs are mainly used but certain bee logs are fabricated in conformity to the variable shapes of original trees, so that one may be curved or of a unique shape fitted with 3 to 5 openings by making an ingenious use of positions of branches. Normally the opening on the end with larger outside diameter is made to serve as one for the maneuver of harvesting. The felled tree is let dry sufficiently for about 3 months to one year (to the extent that bark gets dry enough to be peeled off easily). By this process, they can prevent the cracking of cylinder walls after being hollowed out or the damage by insects

(beetles) which bore holes on bee logs. Dried log is hollowed out from the end which is used as the opening for harvesting. When the work of hollowing out is finished, 2 disk-formed lids to cover the openings on both ends are carved out from the same log for beehive. On the cylinder wall two recesses are carved on the diametrical positions, and on the lid 2 bosses are similarly carved on the periphery to fit snugly into the recesses. Furthermore, on the lid sometimes several holes with a diameter of around 1 cm are bored as entrances for honey bees. On the bee log a marking (uvano) to indicate the owner is branded at a position opposite to the opening for harvesting and visible to observers on the ground. As tools for branding, heated wires or metal pieces are used.

Furthermore, before putting the bee log in place, beekeepers treat the inner wall by rubbing it with leaves of an aromatic plant of mint family, *Ocimum* sp. (mutaa: a kind of basil) or sun-dried old honeycombs (masoso) to put scent to the log. Honey bees are believed to have a nature to like these scents. It takes about a week to complete all the processes of fabrication. Bee logs are never sold on the market, and most of them are custom-made products by the hand of wood carving craftsmen.

2) Mounting of bee log

Since in the Makueni District lying to the southwest of Kitui District, where people can witness around September the colonies of honey bees (those making hives) flying from the Kitui District in pursuing the sun moving southward, it is assumed that the period from August to September is the best season for mounting of new bee logs. The placement of bee logs is limited to a location to satisfy several requirements as follows: i) sufficiently distanced away from residences, ii) close to water sources, iii) with abundance of honey sources, iv) accessible even when heavy rainfall occurs. In the selection of type of trees for mounting, following characteristics are considered. i) ever green trees branching out large boughs, capable of protecting hives from wind and rain, i) high enough to assure security to humans and animals on the ground, ii) without thorns, iii) presence of sufficient number of branches to facilitate the work including harvesting (particularly for bee logs of fixed type), iv) branches are supple and easy to break, v) few depressions and

protrusions on the surface of trunk and boughs to discourage the climbing by animals seeking honey (Table 3-3- 1 : trees suitable for mounting bee logs) . One tree accommodates about 1 to 10 bee logs with an average number of 2 to 5. Bee logs are mounted on trees by either one of two ways. One is the traditional type of fixed bee log, and the other is the type of suspended log (improved type).

3) Management of bee logs

Although emplaced bee logs have been treated with scents preferred by honey bees, the essential fact is just that beekeepers have to wait for bees coming to settle them. If they are not settled for a long time, the inside of cavity walls is newly treated with the scent by rubbing it with leaves of plant of mint family, *Ocimum americanum* (mutaa : honey basil) or *Ocimum gratissimum* (yenye). Furthermore, when, in spite of the presence of honey bees, honeycombs are not made large, it is believed that the activities of bees are stimulated by washing the lid on the opening for harvesting with a solution of juice obtained by squeezing the leaves of a species of solanaceous plant, *Solanum incanum* (ngondu).

Traditional beekeeping in Kitui is practiced through the application of a series of inventions and techniques including exploration of suitable habitats for honey bees, provision of bee logs that create spaces similar to natural ones, and moreover the enterprising exploitation of attractant plants. On the other hand, it is essentially based on the patience to wait for the settlement of wild honey bees in bee logs without aggressive intervention in natural process of reproduction of honey bees or in the management of honey bee colonies.

In the past, in the domain of development assistance, such a traditional system of management has been treated as one equivalent to primitive honey hunting. However, the traditional management system is based on the accumulation of traditional experience and hereditary knowledge realized by local people who have succeeded in sustainable production in harmony with local natural environment. In the future, the system of that nature would have to be verified and evaluated in higher scientific terms from the view point of adaptation in the face of climate change or from that of sustainable production.

4) Species of honey bees

All types of traditional beekeeping of Kamba exploit wild honey bee species. Traditional beekeepers classify them into groups as follows according to morphological characteristics including size, appearance and color of body hairs, appearance and color of wings, location of construction of beehives. The home range of honey bees is assumed to be within a radius of about 3 to 5 km around a bee log.

i. saki : the most common honey bee in Kitui. Small but with ferocious nature. Yellow stripe present in the abdomen. Body size is small but it makes a bigger hive compared with that of group 2 nzingu.

ii. nzingu : rather larger in size with milder nature compared to saki. Black-tinted as a whole.

iii. ikalamata : further larger than the group 2 nzingu. Bearing reddish brown and yellowish hair. Particularly legs are covered with thick hairs. Wings do not rest while reposing.

iv. wuli : characterized by reddish body. Larger than group 1 saki.

v. Queen bee: very big, laying eggs, only one is found in the center of a beehive.

vi. Ngiru (a species of stingless bees) : black and very small bee. Smaller than fly, follows about humans in seeking for water during the dry season. It makes nests only on natural tree trunks, which makes it very difficult to locate them, yielding only small quantity of honey but honey of excellent quality can be obtained.

vii. mbuo (a species of stingless bees) : a bee that constructs subterranean nests. It is small in size, bears yellow hairs and shows black belt-like lines on body.

5) Harvesting time

Wood carving craftsmen say that the yield of honey depends on the following factors:

i) Nectar plants as sources of honey,

ii) Number of bee logs settled by honey bees,

iii) Number of bees in a bee log.

In Kitui District, honey harvesting is concentrated during the months from February to May. The months of January and February are the time when the rainy season is already over and fair weather prevails mostly, and many plants, including not only crop plants sown in the rainy season like maize and melons but also wild plants like acacias, blossom out. At this time, activities of bees are also lively and we can frequently observe them moving around busily to collect water, nectar and pollens from various places around the house like wells and henhouses. In the smaller rainy season lasting from March to mid-May beekeepers can expect lots of honey. The honey collected at this time is white, smooth and tasty. At this time when the activities of honey bees are most vigorous the farm work is also busy by overlapping the harvesting of crops grown during the great rainy season and the cultivation of crops for the small rainy season. The period from June to October is the great dry season (cool season) that is followed by the great rainy season lasting from late October to early December. During these seasons, honey bees consume stored honey and reproduce. Although such plants as mango and *Melia volkensii* (mukau) , species of family Meliaceae, bloom before the onset of the great rainy season in October, the yield is too low to be compared to that obtained during the season from February to May. Honey can be harvested 4 to 5 times in a year when the yield is abundant, or 1 to 2 times in a lean year.

The yield varies greatly depending on the years and the bee logs. Annually about 5 to 20 kg of honey can be collected per bee log. It is said that recently it takes longer than before until log beehives are filled with honey. Beekeepers have analyzed this problem and concluded that the delay is attributed to 2 factors: i) reduction of rainfall, ii) recent reduction of wild trees, sources of nectar, as a result of the expansion of cultivated land and the indiscriminate deforestation, namely, the intensified tendency that honey bees have to rely on cultivated crops as nectar

sources. Another problem also concerns constraints posed by humans where the felling of trees suitable for emplacement of bee logs, for charcoal making, leads to not only the reduction of trees and environment needed for installation of bee logs but also to the damage by more frequent incidence of absconding of bees due to smoke emitted by charcoal making.

6) Method of collection

Collection of honey is normally carried out by a pair of persons, an adult (normally in charge of honey collection) and a child (assistant). It is said that the honey collector is either naked from the waist up or covered by wearing a tattered shirt with holes under working clothes so that bees may not get under the garment. Firstly, during the daytime of harvesting day the honey collector identifies the beehives to work on. The optimum harvesting time of each log beehive is determined by the degree of swarming of bees outside it. Collection starts when it gets cool after sunset to avoid the attack of honey bees. Upon arrival at the site, collectors make fire and ignite a torch made of a bundle of twigs of a tree called umui to generate smoke. Honey in all the log beehives mounted on a tree has to be always harvested on the same day. The collector introduces the smoke from torch into the log beehive through the opening for harvesting to drive away honey bees to the other side of the cavity. When the activity of honey bees becomes subdued sufficiently, the lid on the opening for harvesting is removed and a new blow of smoke is introduced, and honeycombs are cut away carefully one by one with a knife and put into harvesting buckets. Since the smoke used for fumigation contaminates the honey with aroma, it is an important element to select the type of trees used for making the torch.

As a criterion of the extent of harvesting honeycombs, about one third of the length of bee log or, even in case of harvesting a large amount, up to a half of it (around 50 cm) out of the total length of honeycomb should be harvested, leaving the remaining portion undisturbed, before replacing the lid. Care should be taken so that the collector may not harvest the whole honeycomb but limit the extent of harvesting, in order not to damage the queen and the brood, and within the

uppermost extent which still assures that no absconding may take place. It is believed that another harvest can be expected in 1 to 2 months if the activities of honey bees are vigorous. When a certain colony contains a large brood population and has very active and defensive work bees, it may not allow harvesting. In such a case, harvesting is carried out after subduing the activity level of the colony by lowering the hive temperature by means of a preparatory treatment of sprinkling water on the bee log and the surrounding area.

Harvested honey and honeycombs are brought home and crushed by means of sticks to extract honey.

7) Types of honey and prices

Honey is classified into 3 types according to the differences in color and use by attaching a specific name to each type.

i. mutikulu / mutitiiku: honey with dark colors of yellow and reddish brown. It can be collected from black beehives called ngee. Since the honey of this type sometimes tastes slightly bitter, it is not liked for licking as it is. Because of the abundant presence of pollens, people run a risk of getting stomach trouble if freshly harvested honey is taken too much. Consequently the honey of this type is used for brewing local beer.

ii. wavuva / uki wa nzuki : white honey with smooth taste. It can be harvested from white and brittle parts of honeycombs. It is suitable for consumption without processing.

iii. Honey with a bitter taste (Table 3-3-1 Undesirable nectar plants): if honey tastes bitter, it is returned to the hive. When a season passes, sweet honey of good quality will be able to be harvested from the same hive.

In the market of Kalundu in the Kitui city, honey of the type of mutikulu is traded at a price level ranging from 75 to 100 shillings (US$ 1 = 79 Kenya shillings as of February, 2009) per kilogram, and that of wavuva, at from 140 to 160 shillings per kilogram. In Kangundo, a suburban town of Nairobi lying about 50 km away

from the capital, types of unprocessed harvested honey containing impurities are traded at a price level ranging from 100 to 120 shillings per kilogram, and types of processed honey without impurities, at a level from 160 to 200 shillings per kilogram (1996). Incidentally, sugar was sold for about 40 to 50 shillings per kilogram in the city of Kitui (1996).

8) Use of honey

Honey is not only a favorite treat for children but also valued highly as medicines for various ailments (stomachache, cold, cough, sore throat). Moreover it is used as a preservative to store meat for a long period. It is also used as a raw material for brewing honey beer called uki. Honey and honey beer are indispensable items for wedding ceremony and as bride price or for feasting at local meetings.

9) Use of beeswax (masoso)

Beeswax is melted by boiling in a pan, then poured onto cloth, and then squeezed to remove impurities. When the liquid cools off, the, wax will be solidified on the surface of water. A lot of wax can be obtained from the type of hive called ngee from which honey of mutikulu type can be collected. Derived wax is used to make soap and for repairing broken (cracked) jerrycans. Moreover, sun dried honeycombs are finely torn apart and mixed with dung of donkeys to prepare a material to be used frequently for fumigating field crops to control worms called kivooi infesting flowers of pigeon pea. However, while the yield of beeswax is relatively low - 1 kg of wax is obtained from a beehive producing 3 kg of honey – the price on the market is low and brings little profit, and hence it is not used so extensively. Mr. B living in Museve, a village lying 7 km to the north of Kitui City, whom the reporter interviewed, told that he sold wax for the price of about 30 to 40 shillings per kilogram to a middleman as he was visiting the village regularly. In the market of Kalundu locatted at the city center of Kitui, beeswax is traded at a price level ranging from 50 to 70 shillings per kilogram. It is traded at the price level of about 700 shillings per 5 kilograms in Nairobi (as of 1996). In 2008 in the

market of Kalundu, 1 kg of crude beeswax fetched about 90 shillings, while the refined one was sold for about 150 shillings.

10) Expectation for young generations

In December 2008, the reporter had an opportunity to visit the beekeepers, Mr. B in Museve for the first time after 12 years of absence. At present a grandson of 20 years old has taken over the beekeeping activity, managing 6 bee logs. It is said that out of these 6 bee logs, about 60 kg of honey per year can be harvested in favorable years. He used to manage 35 bee logs 12 years ago. He cited several reasons for the reduction of number of bee logs as follows: i) his legs became disabled and was not able to make new bee logs, ii) until recently, the grandson was attending school and not able to assist him in harvesting work, which prevented him from carrying out this job as much as he wished to do, iii) children were afraid of honey bees and not interested in practice of beekeeping, iv) there were certain farmers who refused the installation of bee logs, being reluctant to approve it because of inconveniences caused for general farming activities, v) because of increased tendency of fragmentation of land holding, the number of places suitable for installation of bee logs had been reduced, and vi) the availability of trees desirable for making bee logs and as nectar sources had been reduced. In fact, the environment (nectar plants, wood for bee logs, places for installing bee logs) desirable for practicing traditional beekeeping is changing, and the quantity of honey to be collected through traditional beekeeping systems is on the decrease. The price of honey free from impurities ranged from 200 to 250 shillings per kilogram, and that of beeswax was almost unchanged from the level prevailing 12 years ago in 1996. He even told a story that beeswax in fact was currently discarded as waste because of too low purchase prices.

In Kitui also, efforts are in progress to extend modern beekeeping by using Kenya top bar hive (KTBH), aiming, by focusing on rural community groups, at contributing to the improvement of livelihood of farmers. However, cases of these activities brought about by external organizations more often than not hit a setback after the assistance is terminated. Regarding this prospect of modernization, the

wood carving craftsmen who accepted reporter's interviews responded in negative terms, citing reasons for not being able to convert to a system employing KTBH, as follows: it is based on an absolutely different management method and techniques; wood carving craftsmen are old aged (unable to participate in training); in the beekeeping practice employing KTBH, beehives are installed at a level close to the ground surface, and hence present great dangers to grazing animals and children caring them, etc. Moreover, they maintain that there is an issue to consider in social context that because beekeeping is a traditional industry which each generation of certain families of a community inherits from its predecessor, if people of the community together organize a group to practice beekeeping, the aspects of distribution and management of profit would present a significant problem. On the other hand, wood carving craftsmen recognize the importance of transmitting to generations of their children and grandchildren the technology of traditional beekeeping, hoping that their descendants will continue to practice the trade. However, due to the depopulation of rural areas, they now have less time to be able to spend together with children to transfer their expertise and enthusiasm to them. Moreover, there is a situation that, because the main use of honey is brewing local beer (illegally brewed alcohol beverage), beekeeping is an occupation lacking attraction as a decent industry. These factors have created the reality that younger generations are motivated to leave beekeeping, rather than to succeed to the occupation of their predecessors.

In the near future, if one contemplates a development project in this sector through intervention by the external initiative, instead of relying solely on the methodology tried for nearly 30 years so far in which the productivity enhancement and the promotion of improved techniques have been the main tactics, a new approach would be called for. Firstly it is needed to assess clearly what kinds of resource farmers possess and through what kinds of way of thinking and method they manage and utilize those resources. Based on such information, the analysis has to be made to determine the possible social concept about the new system of management and utilization in the traditional beekeeping development. Through these processes, the strategy of intervention needed for the construction of new

systems for resource management would be able to be evaluated and identified ultimately from the viewpoints of farmers.

Table 3-1-1 Trees used for traditional beekeeping in Kitui District, Kenya

Species	Family	English name	Local name
Trees suitable for mounting bee logs			
Acacia mellifera	Mimosaceae	Black thorn	kthiia
Acacia tortilis	Mimosaceae	Umbrella thorn	mwaa
Adansonia digitata	Bombacaceae	Baobab	muamba
Commiphora baluensis	Burseraceae	-	itula
Commiphora sp.	Burseraceae	-	mukuu
Cordia africana	Boraginaceae	Large-leafed cordia	muinga
Croton megalocarpus	Euphorbiaceae	Broad-leafed croton	muthulu
Delonix elata	Caesalpinoide	-	mukame
Ficus thonningii	Moraceae	Wild fig	kiumo
Kigelia africana	Bignoniaceae	Sausage tree	kiatine
Lannea schweinfurthii	Anacardiaceae	-	kyuasi
Mangifera indica	Anacardiaceae	Mango	kiembe
Sterculia stenocarpa, S.africana,	Sterculiaceae	African star chestnut	kyusya
Tamarindus indica	Leguminosae	Tamarind	muthumula
Terminalia brownii	Combretaceae	Red pot terminalia	kiuuku
Brachylaena huillensis	Compositae	Silver oak	kiuuku
?	-	-	kyumbilili
?	-	-	muanga(e)
?	-	-	Imula
Trees suitable for fabricating bee logs			
Acacia seyal	Mimosaceae	White thorn	mweya
Acacia sp.	Mimosaceae	-	muewa
Acacia xanthophloea	Mimosaceae	Yellow bark acacia	musewa
Acokanthera oppositifolia?	Apocynaceae	Arrow-poison tree	kikweo
Commiphora baluensis	Burseraceae	-	itula
Commiphora sp.	Burseraceae	-	isavyu
Cordia africana	Boraginaceae	Large-leafed cordia	muinga
Erythrina abyssinica	Papilionoideae	Red-hot poker, Coral Tree	muvuti
Eucalyptus sp.	Myrtaceae	Gum tree	musanduku
Ficus sycomorus	Moraceae	Sycamore fig	mukuyu
Lannea alata	Anacardiaceae	-	mukweo
Newtonia hildebrandtii	Mimosaceae	Newtonia	mukame
Terminalia brownii	Combretaceae	Red pot terminalia	kiuuku
?	-	-	muhunia ndia?

Species	Family	English name	Local name
Trees suitable for pegs			
Acacia mellifera	Mimosaceae	Black thorn	kithiia
Antidesma venosum	Euphorbiaceae	Tassel berry	mukala
Dalbergia melanoxylon	Leguminosae	African blackwood	muvingo
?	-	-	mulineliti/mulinditi
Trees suitable for hooks			
Premna resinosa	Labiatae	-	mukaakaa
Grewia bicolor	Tiliaceae	White raisin	mulawa
Commiphora baluensis	Burseraceae	-	itula
Trees suitable for ropes			
Commiphora baluensis	Burseraceae	-	itula
Acacia brevispica	Mimosaceae	Prickly thorn	mukusyi
Trees used for repairing of bee logs			
Commiphora baluensis	Burseraceae	-	itula
Sansevieria sp.	Dracaenaceae	-	mbwau
Vitex payos	Verbenaceae	Black plum	muu
?	-	-	uswe
Trees suitable for putting scent to bee logs			
Ocimum gratissimum	Lamiaceae	African basil	yenye
Ocimum americanum	Lamiaceae	Hoary Basil	mutaa
Solanum incanum	Solanaceae	Nightshade	ngondu
-	-	Beewax	masoso
Nectar plants			
Acacia brevispica	Mimosaceae	Prickly thorn	mukusyi
Acacia gerrardii	Mimosaceae	Grey-haired acacia	muthi
Acacia mellifera	Mimosaceae	Black thorn	kithiia
Acacia nilotica	Mimosaceae	Egyptian thorn	musemeli
Acacia senegal	Mimosaceae	Gum arabic	king'gole
Acacia seyal	Mimosaceae	White thorn	mweya
Acacia tortilis	Mimosaceae	Umbrella thorn	mwaa
Azanza garckeana	Malvaceae	Tree Hibiscus	mutoo
Cajanus cajan	Fabaceae	Pegion pea	nzuu
Coix lacryma-jobi	Poaceae	Job's tears	nzalangilya
Cordia africana	Boraginaceae	Large-leafed cordia	muinga
-	Cucurbitaceae	Cucumber	
Cynodon dactylon	Poaceae	Bermuda grass	ikoka
Cyphostemma adenocaule	Vitaceae	-	kyuungu
Eragrostis superba	Poaceae	Wilman lovegrass	mbeetwa
Eucalyptus sp.	Myrtaceae	Gum tree	musanduku
Hyparrhenia sp.	Poaceae	-	ndande
Indigofera triata, I.lupatana	Fabaceae	-	lunguyu

Species	Family	English name	Local name
Nectar plants			
Mangifera indica	Anacardiaceae	Mango	kiembe
Melia volkensii	Meliaceae	Melia tree	mukau
Melinis minutiflora	Poaceae	Molasses grass	kithina
Pennisetum glaucum	Poaceae	Purple majesty	mwee
Piliostigma thonningii	Caesalpiniacea	Camel-foot	mukolokolo
Sorghum bicolor	Poaceae	Sorghum	muvya
Tamarindus indica	Leguminosae	Tamarind	muthumula
Vigna sp.	Papilionaceae	Cowpea	
Lablab sp.	Leguminosae	Lablab bean	
Zea mays	Poaceae	Maize	mbemba
?	-	-	muonde?
Undesirable nectar plants			
Acokanthera schimperi	Apocynaceae	Arrow-poison tree	kivai
Agave sisalana	Agavaceae	Sisal	ikonge
Aloe secundiflora	Aloaceae	Aloe	kiluma
Aspilia mossambicensis	Compositae	-	muti
Maytenus sp. (M.putterlickioides?)	Celastraceae	-	muthunzi
Synadenium sp.	Euphorbiaceae	-	kyatha
Vernonia lasiopus	Compositae	-	muvatha
Material trees for harvesting buckets			
Melia volkensii	Meliaceae	Melia tree	mukau
Commiphora sp.	Burseraceae	-	mutungati
Erythrina abyssinica	Papilionoideae	Red-hot poker, Coral Tree	muvuti
Trees suitable for smoking torches			
Agave sisalana	Agavaceae	Sisal	ikonge
Aspilia mossambicensis	Compositae	-	wuti
Flueggea virosa	Phyllanthaceae	Chinese waterberry	mukuluu
Grewia tembensis	Tiliaceae	-	mutuva
Hibiscus sp. ?	Malvaceae	Hibiscus	mulyambila
Lantana camara	Verbenaceae	Lantana	musimolo
Melia volkensii	Meliaceae	Melia tree	mukau
Premna resinosa	Labiatae	-	mukaakaa
Sansevieria sp.	Dracaenaceae	-	mbwau
Capparis tomentosa	Capparaceae	-	itandaa boo?
Pennisetum purpureum	Poaceae	Napier grass	kithale

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3-4 Development of apiculture in Kenya, roles and issues of respective sectors

Since currently in Kenya, the market-determined price of honey is comparatively high, and the view that demand exceeds supply has been expressed in many quarters in the past few years, many aid organizations of the West and NGOs have started to implement various rural development projects integrating beekeeping as the core component. Beekeeping is considered to be the most suitable undertaking as side business for improving the livelihood of farmers, because, if it is run on an appropriate location, it requires only a minimum level of day-to-day management, does not interfere with the occupation of a farmer, can be carried out with surplus labor, and furthermore the product is more profitable than ordinary agricultural crops. However, beekeeping is reputed to be a kind of business that is easy to start but hard to sustain. This is because of the fact that while it can be introduced relatively easily thanks to the package of equipment combined with a short-term training, the required level of expertise for maintenance and management, when it is considered in a long perspective, is high and difficult to provide assistance. Furthermore, it is so because it is needed to make an excessively high level of investment for an individual or for a group of farmers, in order to produce products of marketable quality. This section describes the analysis of method of approach concerning the projects of development of beekeeping in the domains of training, extension, cargo collection and marketing, in order to define an ideal form of apiculture development.

3-4-1 Questions in apiculture development

1) Problems and desirable solutions associated with training and technical guidance

In order to identify clearly the timing at which problems arise from the viewpoints of provision of technical guidance in the effort to introduce and extend

apiculture as a new development project, the overall course of apiculture has been classified for descriptive purposes into the following 4 stages.

A. Introduction stage

When a new beehive is to be introduced anew, it is needed to provide a technical guidance (about a half day) on installation and management before and after the introduction. Since day-to-day management is relatively simple, it needs little technical support. In most cases, the beehives are introduced after would-be beekeepers have received technical training or sufficient amount of explanation which naturally accompanies the purchase of new beehives. Therefore problems at this stage emerge relatively rarely.

B. Development stage

Beekeepers are required to learn various kinds of tasks needed at this stage through repeated practices along with successive stages of development of bee colonies, including the timing of transfer of a colony from a swarm-catcher, the judgment as to whether a particular colony is to be maintained or not by monitoring the development speed of it, and the judgment of the timing to mount a honey super. Since many of those tasks contain elements requiring judgment based on experience, the knowledge and skills learned through training received immediately before and after the introduction are not sufficient, the present reporter considers that this stage should be the time when beginners feel most frequently the necessity of technical guidance.

C. Harvesting stage

When a beekeeper has to carry out harvesting for the first times, it is needed to provide him with correct training for the procedures of harvesting. If equipment has been purchased from a trader, or beekeeping is run as contract production, this process is automatically guided by the trader, and hence would present little of serious problems.

D. Maintenance and management stage

This stage concerns the phase in which, after the bee colonies actually have been established and started to produce honey, they are maintained and continue and expand the production and harvest. It seems that at this stage various kinds of difficulties arise often including maintenance during the dry season, insect pests and predators, etc.

In view of these factors, one can well understand how inadequate the currently standard 2-week course of training on apiculture is, and would realize anew that the continuous monitoring and guidance is essential for the effective technical assistance in apiculture. The situation that the extension agents with knowledge and experience with apiculture are only few and their services of support become unavailable because of their change may readily lead to discouragement to farmers or projects that intend to introduce apiculture as a new element. In a project intending to develop apiculture with a perspective longer than several years, it appears that there is a definite need to train a specialized technical expert by spending time or to make sure to find persons capable of providing technical support at all times.

What the reporter would like to emphasize concerning this matter is the necessity to foster experts on the national level. While a large number of projects associated with apiculture are going to be implemented and human resources trained by short-term programs will increase in the future, it is feared that the manpower really capable of providing support services when serious problems occur in the long term operation of apiculture is very much lacking in Kenya. The government agencies are essentially responsible for fostering such permanently available manpower by spending sufficient time. The actual circumstances that private enterprises and organizations are fostering manpower and providing technical services to support the development efforts should be considered as exceptional ones.

In this regard, it would have to be considered to establish a special course of about 1 to 2 years devoted to apiculture at the National Beekeeping Station to foster

and assign at least 1 apiculture expert per district, even though the fields for practical exercise are to be found on local sites. The present state in which the number of extension agents specialized in apiculture of the level of expert is not commensurate with the number of beekeepers and with the level of emerging needs would not allow the just appreciation of potential of apiculture development in Kenya.

3-4-2 Questions in apiculture extension and promotion

1) Issues in the conversion process from traditional beekeeping to modern apiculture

If one looks at the matter from the viewpoint of improvement of productivity and quality, the trend of conversion from traditional beekeeping system to the modern one using the Langstroth beehive may be in a sense an inevitable process. However, our field surveys have revealed that, until the ultimate stage is reached, there are several hurdles to overcome which are hindering its extension against general expectation. The situation is diagrammatically represented in the following figure:

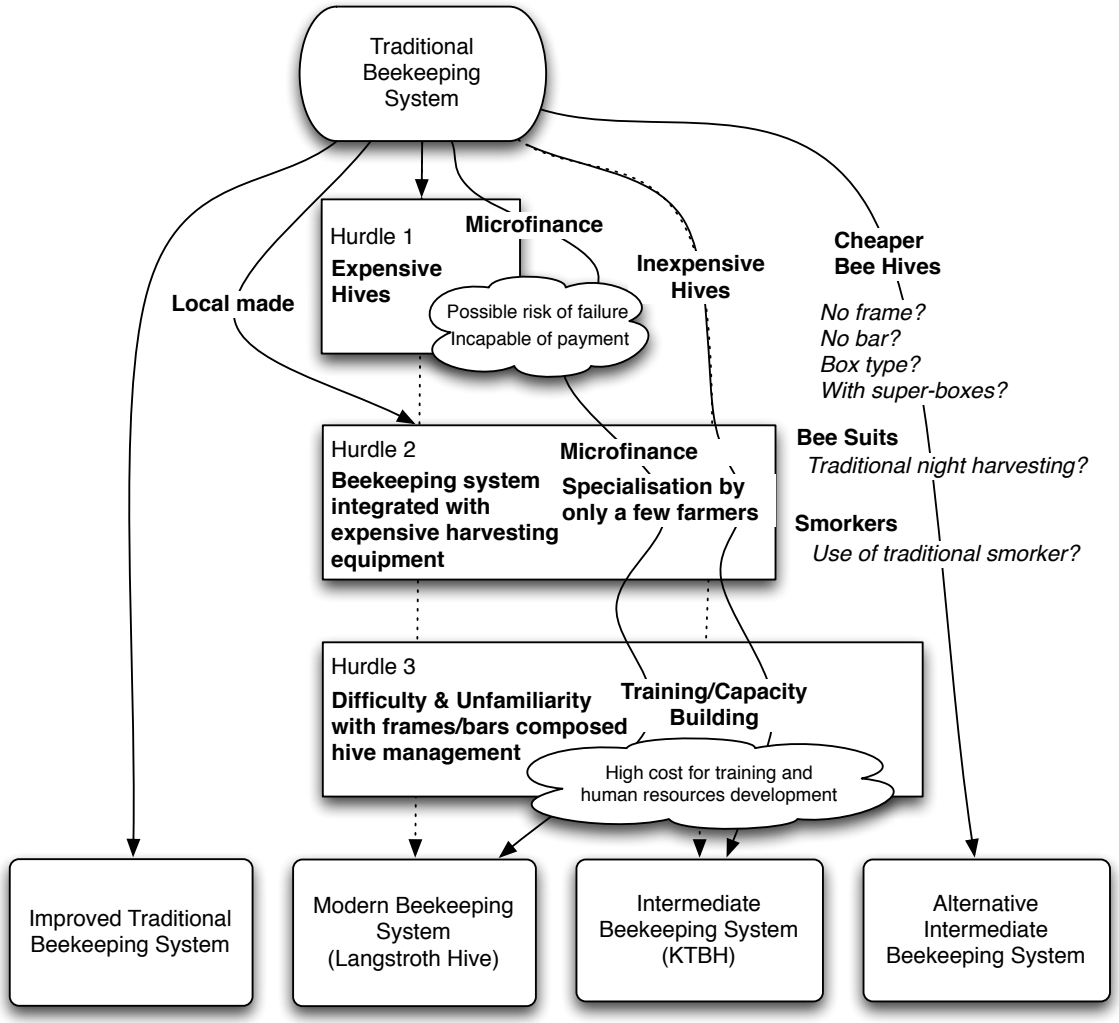


Fig. Possible hurdles existing in the conversion process from traditional beekeeping to modern apiculture and solutions for them.

(1) Hurdle 1 : Costly hive

First of all, the fact that a hive costs about 3,800 to 4,500 shillings, too high a price in comparison with the level of income of ordinary farmers, is the most important hurdle, very often making it impossible for most of ordinary farmers to purchase it independently. In order to overcome this hurdle, in aid programs, funds of donor agencies are invested or a certain credit arrangement using a device of microfinance is made to allow farmers to purchase the hive. However, considering that it is doubtful whether every farmer having introduced it is able to realize predicted yield and profit, it cannot be denied that these kinds of

measures run a considerable risk. Inversely, would not it be rather advisable to promote more a policy to introduce the hive at a lower cost by fabricating it on one's own? Although there remained a problem of quality, the reporter came across a certain farmer in Mwingi District who had managed to have the hive fabricated by asking a local carpenter to make it at a cost about half as much as that of commercial products.

(2) Hurdle 2 : Technology system integrated with costly harvesting equipment

Modern apiculture is a technology system which requires beekeepers to learn the use of not only the hive but also other expensive special pieces of equipment including bee suits and smokers which farmers have to purchase. Regarding this matter also, donor agencies may pay for the equipment to be introduced, but such a scheme to donate these kinds of equipment, at least one unit of which essentially has to be owned individually by a farmer or a group of neighborhood farmers, will necessitate considerable expenditure of funds. It would be also necessary further to explore and teach to beekeepers an approach to use alternative articles of equipment which may be fabricated locally or more easily available.

(3) Hurdle 3 : Unfamiliarity and difficulty with the management of beehives composed of frames and bars

Regarding this aspect of modern apiculture system, the training would solve the problem to a certain extent, but it may be a fairly difficult task for beekeepers to learn fully this part of the system through the existing standard 2-week training program. Moreover, it may also involve a considerable amount of cost to have them trained for a series of processes.

Regarding also the system of Kenya top bar hive (KTBH) which has been introduced as inexpensive equipment, although the cost is roughly half as much as that of Langstroth hive, it still is not a cheap article to buy for farmers. Moreover, it essentially possesses a technology system common with that of Langstroth hive, presenting the same constraints cited for (2) and (3) as above. This fact may explain the reason why the KTBH has not been extended as widely as it has been expected to.

2) Necessity of alternative intermediate technology

Isn't it possible to consider more simple intermediate technology? For instance, we may be able to try a system like the traditional one found in Japan in which there is neither frame nor bar and only a honey-super provides the harvest. If an intermediate technology is applicable, beekeepers that possess only the traditional system may be able to switch over to it without incurring much cost.

3) Issues concerning the improvement of traditional beekeeping

Another possible solution is the improvement of traditional beekeeping system. While it is reputed to have disadvantages like the risk of work, low qualities, and low profitability, aren't there any remedial measures? The reporter actually has found out through the surveys for this time several solutions as follows:

(1) Solutions for the risk of work

In the most common traditional beekeeping, hives are mounted on trees. This position may have been chosen with reason to evade the damage by wild animals and the theft by humans, but it is said that the work becomes very risky and casualties are frequently caused. Moreover, the necessity for climbing trees limits the possibility to make beekeeping a side business for women[1]. There may be an alternative orientation to pursue in which the custom of emplacement of bee hives on trees should be changed gradually to one in which they may be placed in the field or under short trees, just as certain groups of farmers that were witnessed in the survey for this time are practicing it.

1 Many ethnic groups in Kenya have nurtured a traditional belief that it is a taboo for women to touch beehives.

A hive suspended under short trees to facilitate management

(2) Problem of low quality

In the traditional beekeeping, since normally the whole honeycomb is collected[2], the comb material, pollens and brood are also mixed in honey, creating an unfavorable condition for selling the product as honey. A technique which appeared as a practicable solution for overcoming this problem at the level of producers/beekeepers is the queen-extruder net as applied for the traditional type of log beehive. The idea has originated from somewhere else but it is apparently being accepted rather widely in the Districts of Kitui and Mwingi. As shown in the picture, the device is composed of a wire netting with meshes of an appropriate size, and placed in the center of a log beehive for application.

2 It is reported that skilled traditional beekeepers, in harvesting honeycombs, preserve carefully the reproductive parts of honeycombs and put them back to hives.

Queen-extruder net for the traditional type of log beehive

Other devices that are interesting as ideas for improvement at the level of collection and processing plants include an attachment called “comb holder” (Mwingi Honey Marketplace) to be mounted on a centrifuge when disconnected combs collected from traditional hives are centrifuged, and a type of press (Site Enterprise Promotion) which makes it possible to extract honey without resorting to a centrifuge. Particularly the press which has been devised by Site Enterprise Promotion, although it would need further improvement, can be fabricated by local craftsmen, and moreover would be suited for the application at small-scale processing plants.

Attachment for pretreatment of crude products from traditional beehives before centrifuging（Comb Holder）

Mannually operated appliance to squeeze crude products from traditional beehives

(3) Measures to ameliorate the constraint of low profit

Unlike the system based on Langstroth beehive which can harvest only honey without wasting other structural components, the system with traditional beehive has a shortcoming that, as it harvests honey together with the whole honeycomb, it removes other hive materials as well simultaneously. However, such a shortcoming could turn out to be rather an advantage, now that the price of beeswax is increasing. Assuming that about 20 kg of crude products collected from traditional log beehives (normally 4 to 5 logs), are able to give about 16 kg of honey and around 3.2kg[3] of beeswax, the monetary value is compared with that from the system of Langstroth hives as shown in the table below. It is revealed that the profitability becomes higher by about 30 % if honey and wax are combined together than honey only, because currently the price of beeswax is higher than honey. It can be expected that the profitability as a whole will improve by combining the implementation of measures for improving quality as mentioned in the preceding section and the commercialization of beeswax.

3 Based on interviews with Site Enterprise Promotion

Table of comparison of profitability[4]

Product	Production (kg)	Unit price (shilling)	Price (shilling)
Honey（Langstroth system）	20.0	110	2,200
Honey (traditional log hive system)	16.0	90	1,440
Beeswax	3.2	200	640
Total of traditional log hive system			2,080

4 Selling prices are based on those at Mwingi Honey Marketplace

Chapter 4　Community development and apiculture

4-1　Rural development and apiculture

1) Significance of apiculture

Apiculture is primarily appreciated for the excellent properties of honey as its immediate product that can be preserved for a long time as food and is of highly nutritious at the same time, and for several advantages contributing directly to the improvement of life of farmers practicing beekeeping, because it can be used as a medicinal substance for applying it externally as well as for adding sugar ingredient in drinking water.　Secondly beekeeping is preferred for the assurance of income from side business that it provides for farmers, because the surplus honey has been already commercialized generally in many regions and hence it is able to be sold easily and profitably to a certain extent without little marketing effort so long as the amount is limited. Beeswax, readily available as a byproduct, can be used as raw materials for various products such as the base of hand cream, and also can be converted into candles by simple processes.　These processed products can either be used by farmers for their own daily needs or be exchanged for cash similarly as in the case of honey.

Another significance of apiculture is the role of honey bees as pollinators in agricultural fields. Even if pollinators are not particularly needed generally where abundant natural pollinators are present, it has been recognized that, by using managed pollinators, not only the rate of fruiting increases but also, in the case of oil crops, the weight of seeds increases and their quality such as oil content is enhanced.　While the gramineous crops which are grown in many regions to get staple foods are wind-pollinated and require no intervention by honey bees, in the production of fruits, other seed crops, and seeds of vegetables, the role of honey bees is important, and the productivity improvement by assisted pollination on the part of plant sector will translate into enhanced cash income for farmers just as the direct product of the insect.

2) Significance of apiculture in developing countries

In developing countries, the migration of rural people to urban areas constitutes the main cause of impoverishment there and hence the factor enabling the production for ready cash earning has an aspect to prevent the exodus of population. In this regard, the apiculture can be seen as a type of economic activity likely to produce an immediate result for regional development. Moreover, in a development project aiming at regional development and affirmative of sustainable development, it would be unjustified to contemplate purchasing costly hives and introducing imported honey bee species. Consequently, hives will have to be made locally and wild colonies found locally are to be exploited, if such ones are available. Regarding the fabrication of hives, although high precision woodworking skills are essential in order to build a multifunctional hive of high quality, if objectives are clearly defined in accordance with respective local conditions, it is not always necessary to introduce multifunctional beehives. The scheme will also provide opportunities for local carpenters to undertake new jobs of building honey bee hives. Furthermore the scheme will lead to another phase of enhancement of living level of local communities by self-help effort of farmers, through teaching to them the skills of carpentry of a level necessary for fabricating beehives which may eventually be applied also for repairing their houses by themselves. If the beehive to be fabricated can be of a type of single function or of a simple type allowing a certain extent of lesser requirements, the fabrication is not so difficult where carpenters with skills of a level enough to build ordinary houses are found.

Apiculture development without introduction of imported honey bee colonies assumes as prerequisites that wild honey bees as local resources are indigenously present and that the traditional beekeeping technology exists among local inhabitants. It starts with the step of capturing wild honey bees which basically could be the immediate application of techniques for traditional beekeeping depending on spontaneous settlement of wild colonies for starting the process. Therefore, in general, the apiculture development project in such areas takes a form of intermediate system between the traditional beekeeping and the modern apiculture. This approach is an excellent type of technology transfer from the

viewpoints not only of the inheritance of traditions but also of the technical continuity in which existing technology systems can be exploited to be further developed to create a new technology system as a new advanced stage. The progressive approach has also an advantageous aspect that farmers can readily accept a new technology system while preserving self-esteem by seeing the respect paid to their traditions.

On the other hand, the introduction of imported honey bee species entails many negative aspects. Firstly, it inevitably presents the fact that the honey bees as a fundamental production capital are costly, and secondarily there arises a problem that, since they are foreign organisms, it is necessary to consider also the impact on the local ecosystem. Furthermore, when the number of introduced colonies is small, the cross breeding between closely related strains develops which, depending on cases, may lead to genetic degeneration. Consequently, even after the apiculture system has been established, new honeybee lines have to be imported continuously. The exploitation of indigenous honey bees will also lead not only to the economic sustainability of local residents but also to the sustainability of ecosystem surrounding the living environment.

Regarding beehive equipment, in Africa a type of hive equipped with top bars which is economical for fabrication as well as can realize the basic concept of modern beehive, namely, independent manipulation of individual honeycombs, has been developed (it is called Kenya top bar hive (KTBH), because it has been developed in Kenya). The hive comprises only top bars instead of movable frames to hold individual honeycombs in a modern beehive. The main body of the hive has a particular profile in which the cross section takes a trapezoidal form so that honeycombs constructed by bees shall not be connected to hive walls, and a honeycomb attached to each of top bars hangs down from it and takes a semicircular form. With this type of hives, since each unit of honeycombs in a hive can be handled independently, beekeepers can take out only those filled with honey for extraction or easily divide the colony in the propagation season. It is also possible to utilize a queen excluder to confine the queen bee to one part of the hive, in order to increase the number of honeycombs for filling honey. Unlike the system using movable frames, because a top bar hive does not use the comb foundation, the

centrifuge for honey extraction destroys honeycombs. Furthermore, because it allows also the honey extraction by means of the traditional method of compression, in many cases broken pieces of honeycombs can be harvested as beeswax.

Incidentally, the job of transferring a bee colony having settled in the traditional hive to a modern hive is called colony relocation operation, the step which is not found in the normal modern beekeeping system that starts with an existing hive containing an already settled colony. Consequently, few experts working in apiculture have experience of the practice of this operation. On the contrary, in local communities, the operation is essential for the enhancement of profitability out of the traditional beekeeping as well as for raising the technical level of apiculture as a substantial economic sector, and hence it is an important question how to fill this technical gap. However, this technology has the characteristics of intermediate technology that has evolved and been created simultaneously and independently in multiples of versions in conformity with factors of beekeeping specific to each region, including nature of honey bees, the type of traditional hives, or the shape of introduced hives. Basically, it would be called for to accumulate and systematize these different versions of technology.

3) Secondary impact of apiculture development

There are other aspects of impact of apiculture development. As describe above, when a beekeeper needs to acquire wild honey bee colonies, he has to know that their habitat is more often found in forests where tree hollows are available as cavities for nesting. However, in the area where clearing of land is progressing, generally more often than not the density of inhabitation of wild bee colonies tends to be low, depressing the probability of acquiring honey bee colonies which would come flying. Therefore, it is advisable to incorporate apiculture as a component when a rural development project through improvement of environment encompassing an entire region is planned. Because, if the project donor expresses a view to advocate the representation right for honey bees at the meeting of villagers, the structure of conflicting interests among villagers would be able to be looked at from a more objective viewpoint. Through this approach, it would be highly likely

that residents will understand that all factors constituting their living environment do not exist independently to each other but they are closely related, as observed in the causal relationship that the presence of honey bees leads to the increase of crop production and that the forest to be preserved for the benefit of honey bees also serves as the important water source of the village. Furthermore, villagers shall be readily motivated to understand better the environment around them and to show an interest in the subject matter of preservation of environment, by asking them to cite names of plants from which honey bees collect nectar and pollens, and to make a calendar according to the time of flowering of various plants. Likewise, it would be expected to make impact also on farming in general where farmers will learn to predict to a certain extent climate change of a particular year judging from yearly shift of flowering time of plants.

4) Advantage of apiculture in rural development

The advantages which apiculture presents for rural development in developing countries are summarized as follows:

i. Since apiculture exploits resources available in an unclaimed space within a radius of a few kilometers from a hive, all that a beekeeper needs to have is a space sufficiently large to place the hive. In short, apiculture does not require land, and even a landless farmer can benefit from it.

ii. Regarding honey bees, also wild colonies can be exploited. Although essentially hives have to be prepared, costly modern beehives are not necessarily required. Hence farmers without much money also can start the activity.

iii. In apiculture, farmers are not required to carry out daily routine management tasks such as feeding bees. If the harvesting can be carried out, similarly as the traditional beekeeping, only after a certain amount of honey has been accumulated, even those farmers having little time to spare can start the activity.

iv. Most of operations in beekeeping are work on light duty, and hence any person irrespective of age and gender can perform them. They are carried out in the vicinity of dwellings, and therefore the business can be introduced without imposing many burdens on household affaires or hindering school attendance.

v. In the space utilized by honey bees, no competition with other organisms takes place. When a new crop is to be introduced for an extension project in developing countries, it is normally required to replace certain kinds of crops that have been cultivated so far on the land where the new crop shall be grown. In the process of evaluating the appropriateness of introduced crop on the land, there is also a likelihood of loss of certain existing things, presenting a great measure of general risk. In the case of introduction of honey bees, no competition for land or for water takes place, and hence existing conditions can be maintained as they are and still apiculture can be introduced as a supplementary element.

vi. In terms of resource utilization, honey bees pose no competition with other organisms. In certain of development projects, goats are introduced as a key element. However goats inflict a great measure of damage by grazing on the undergrowth of forest to an extent which makes it impossible to restore the vegetation. In cases of domestic animals, the addition of new animals inevitably increases the load on the environment surrounding a community. In this respect, honey bees impose no load on the vegetation nor pose any competition with other animals for food.

vii. Honey has been recognized as a safe and healthy food with a long history of consumption all over the world. Because of its excellent quality for conservation, it can easily establish the position as a regular food for families and as a household medicine. In case of selling surplus honey, people in the community often understand its value and there is no difficulty in finding purchasers.

viii. While there are needs to solve certain types of technical problems, in principle, the production of products other than honey, including beeswax,

propolis and furthermore royal jelly, is possible in any regions, each of these constituting a highly profitable product.

ix. Thanks to the pollination effected by honey bees, the yield increase and the improvement of quality of local agricultural products as well as the pollination in ecosystem are enhanced and maintained.

x. Through the activities of rearing honey bees, people will cultivate interests in the environment of the region where they live, raising the level of awareness for the participation in a project of livelihood improvement, and become capable of judging objectively the priority of each element of the project.

In order to benefit from these advantages in an actual project of apiculture development however, there are a certain number of hurdles to overcome. Firstly the very short period allocated for the standard training program presents a problem. The nature of beekeeping necessitates carrying out various management processes occurring throughout a year. Therefore, although basic techniques of beekeeping can be taught in a short period, many essential processes falling on a particular season of the year often cannot be transferred in the fixed program. Generally, the succession of beekeeping expertise takes place in the institution of apprenticeship in many societies and, as a matter of fact, this poses a great difficulty in the present effort of extension of apiculture. In an actual extension project, the longer an expert remains on the local area, the higher the level of attainment of project tends to become, and furthermore the bigger the achievement may be, depending on the nature of technical expertise of the expert.

5) Problems and orientation of apiculture in the rural development

In this course of reasoning, what seems to be the point particularly important is the question of what sort of thing can be expected as the goal of technology transfer, signifying that the success of a project of apiculture development depends greatly on the clarity of vision of the goal pursued. In other words, the question is whether the parent project itself which incorporates apiculture component possesses a clear vision about the region constituting the target of development aid.

Unfortunately, many of apiculture development projects limit their goals within the extent of technology transfer and the building of framework for technology transfer, stopping far short of the ultimate goal of development and hence losing the real significance of apiculture development. In the case of apiculture also, as describe above, it is possible to undertake a project to extend new technology even in a region needing developmental assistance, as long as relevant indicators prove that from the beginning there exist the traditional beekeeping system as well the environment providing a viable habitat for honey bees. In this case, there is a high likelihood that honey can be produced and duly sold, but such a scenario alone does not necessarily signify that the goal of apiculture development has been achieved.

Honey is a honey bee product easy to sell as long as containers are available but many honey products find it difficult to establish a stable reputation. More often than not they are liable to become victims of an irresponsible reputation. The problem is not unique to honey, but locally produced commodities tend to receive a low esteem in local markets of developing countries, and actually in the case honey, many of marketed articles are considered there as "fake products" containing additives like sugar. If the production increases as a result of the expansion of apiculture, or prices start to fall due to the competition among suppliers, such a reputation would instantly spread widely. It would create a great difficulty to regain the consumers' confidence if it is lost once, so much so that if the products are exposed to such an unfavorable reputation after the distribution channel has been enlarged, it may sometimes happen that the entire aid project for rural development would be doomed to collapse. The enthusiasm of participants in other projects supported by the same agency may also be liable to evaporate. In order to evade such an eventuality, it is important to arouse in the mind of participant farmers the awareness of product quality.

There are also found many cases where project supporters live overseas and products are exported to foreign countries. In such a case as well, it would be a desirable situation that the farmers having introduced and producing products know well about the products or have experience of consuming them and are actually able to consume them at present. The awareness that they are producing the finished products rather than a crude material should become an indispensable

condition for improving the quality or for maintaining a high level of it.

Current apiculture development projects in Africa are carried out by arrangement in which modern beehives are leased or sold on credit to farmers and the rental cost or price is collected by means of produced honey. Although the utilization of surplus honey is left to farmers' disposal, the production technique itself cannot be said to be adapted to local conditions. The reasons for the disparity are largely accounted for by the fact that beehives with too many functions are offered and that the level of woodworking skills in fabrication is still low.

For example, the beeswax produced in Africa is highly appreciated as industrial material on the world market. Hence it is possible to introduce apiculture principally aiming at producing beeswax. For that purpose, the traditional type of beehive in which beeswax is obtained as a byproduct in the process of collecting honey is better suited than the modern type of hive in which honeycombs are reused repeatedly. In Kenya a certain type of intermediate technology like the one in which a queen excluder is mounted on the hollow log hive is coming to emerge. The collection of beeswax is also in progress.

If honey is replaced by beeswax as product, the amount of production is reduced to about one eighth in volume. If the production of beeswax of high quality is possible, the problem of lower production volume can be compensated by imposing higher prices to a certain extent. If one takes account of such a situation, it might be necessary to envisage a future course of evolutionary development to promote apiculture principally aiming at the production of beeswax.

Regrettably in this sector the apiculture development tends to be undertaken rather as a process to extend better beehives as the primary step, without a global view of the ultimate goal. Moreover farmers as recipients of initiatives cannot be motivated readily unless hives of a fine appearance are shown.

The effects to be generated by honey bees are diverse, and in order to exploit them it is essential to have the density of colonies of wild honey bees in a region raised by apiculture development. With a view of such a requirement, some technical aspects in rearing honey bees can be ignored to a certain extent. In view of an existing circumstance that, on the one hand, the actors promoting apiculture

development have undergone the experience in modern apiculture and tend to be reluctant to slough off it, and on the other, farmers from recipient side tend to deny traditional values and seek tools as new as possible, in reality it might be difficult to try to promote the development through creating alternative intermediate technology.

4-2 Apiculture and environmental conservation

4-2-1 Natural resources and apiculture

Although the figure may differ depending on the level of development of a particular country, in Kenya more than 90 % of beekeepers are practicing traditional beekeeping. The proportion is likewise in neighboring countries as well, i.e., Ethiopia (99%[5]) , and Tanzania (95%[6]). Moreover, farmers and enterprises practicing modern beekeeping also utilize wild honey bee colonies by seducing the swarms into their hives. Putting aside the question whether such honey bees should be called wild organisms or domesticated animals, at any rate they constitute colonies having derived from the natural ecosystem that are beyond the complete management by beekeepers.

Furthermore, the regions in Kenya with flourishing beekeeping which are said to have potential are found in the semi-arid areas of Eastern Province and Rift Valley Province, and are mostly under natural conditions not suited for large-scale farming[7]. In these regions, reflecting the unstable and scarce rainfalls, agriculture itself is of small-scale and assumes a strong nature of self-sustenance, and therefore the beekeeping there generally depends to a lesser extent on agricultural crops for nectar sources. Furthermore, since most of the agricultural crops eligible as nectar sources (coffee and fruit trees) have been introduced only in recent years as commercial crops, many of them have not been utilized as nectar sources for traditional beekeeping. Under such environment, beekeeping is practiced under a condition where natural vegetation, particularly trees, rather than agricultural crops, are mostly exploited as principal nectar sources.

Consequently, in many countries in Africa, traditional view of beekeeping

5 International Trade Centre (ITC), Ethiopia 1986

6 Tanzania-The status of Tanzanian honey Trade- Domestic and International Markets
Mwakatobe, A. and Mlingwa, C. Tanzania Wildlife Research Institute, a paper presented at the Bees for Development Honey Trade Workshop held in Dublin, Ireland in August 2005.

7 Or there could be an aspect that the very environment unfavorable for crop production might have obliged the prosperity for beekeeping.

considers that it depends on natural vegetation and forest, and in many regions honey is treated as a forestry product[8]. For example, in Tanzania the Bureau of Forestry and Apiculture is under the jurisdiction of Ministry of Natural Resources and Tourism, signifying that agencies in charge of forestry and apiculture are included in the same administrative organization, and an apiculture course (specialized 2-year course) is provided in the school of forestry. Essentially, it is ideal that a government agency in charge of management of nectar sources exercises jurisdiction over the apiculture development itself, and in many instances that kind of system works best for developing the industry of apiculture.

If apiculture resources are classified into two elements, honey bees and nectar sources, the apiculture in Kenya and similar countries in Africa could be characterized as one which depends on natural resources and on natural ecosystem for the both resources.

4-2-2 Apiculture and natural environment conservation

Generally speaking, once local people begin practicing apiculture, they become accustomed to be conscious of their relation with apiculture resources surrounding them through honey bees and the products. They begin to think about the question from where honey bees settling hives originate, and to contemplate the relationship between the abundance of stored honey and that of flowers coming to bloom.

In the areas where the acquisition of honey bees depends on wild colonies and the nectar sources depend on natural vegetation, the basic elements of apiculture derive from the richness of the nature that provides two resources. Therefore the closer the relationship between life and apiculture becomes, the much higher the consciousness of conservation of forest and natural vegetation is raised. This is because unless the swarms of honey bees are observed frequently, the settlement of

8 In the document " NON-WOOD FOREST PRODUCTS IN AFRICA: A REGIONAL AND NATIONAL OVERVIEW, FAO, August 2001", 19 countries out of the total of 55 countries studied, namely:、 Egypt, Ethiopia, Sudan, Tanzania, Uganda, Comoros, Mauritius, Lesotho, Malawi, Mozambique, Namibia, South Africa, Swaziland, Zambia, Rwanda, Republic of Congo, Benin, Gambia, Mali; honey has been classified as the forestry product.

hives by wild bee colonies does not take place, and unless there is an abundance of plants coming to bloom in the surrounding, honey production is poor. People eventually come to realize through experience that unless they conserve and manage the natural ecosystem appropriately, apiculture itself would not be able to keep on going any more.

As seen above, by aligning the objective of apiculture with the orientation of conservation of natural environment, in such regions, the apiculture not only serves for improving people's livelihood and for developing new industries but also comes to hold a particular significance for the conservation of the natural environment. Hence, the apiculture development has made it possible to raise people's awareness of the natural environment and to lead them to engage in the conservation activities.

In the context as described above, phases of conservation of natural environment could be summarized into the following 6 categories:

1) Conservation of natural forest and natural vegetation (breeding grounds of wild honey bees)

Since apiculture depends on swarms of wild colonies, the necessity of conservation of wild bee colonies as the source is recognized. As activities resulting from the recognition, the conservation of natural vegetation, habitat of wild bee colonies, for their breeding grounds can be cited. In Kenya one can still now observe the examples of such a type of traditional efforts toward the conservation of natural vegetation.

2) Conservation of natural forest and natural vegetation (conservation of nectar sources)

In the apiculture which depends on the natural vegetation for nectar sources, the richness of natural vegetation assures the richness of the nectar source and sustains the honey production. The ecological structure like this can be recognized most readily by beekeepers from the viewpoint of economics that the natural

vegetation as nectar sources is equivalent to the production of honey, and constitutes the most important element in the principle of conservation. When the activities of apiculture is introduced and developed, the more heavily a region depends on the natural environment for nectar sources, the higher can become the level of improvement of awareness of conservation of natural vegetation (recognition that it is important to respect the forest preserve and to protect the remaining vegetation, from the viewpoint of conservation of nectar sources), and the level of responsive actions of the residents there.

3) Restoration and rehabilitation of natural vegetation

Beekeepers who have got conscious of the reduction of natural nectar sources will become cooperative for the cause of restoration of natural vegetation. Moreover, highly conscious farmers and those depending more on apiculture are able to take responsive actions to facilitate the restoration of vegetation suitable for apiculture on their properties and farmland, such as the exclusion of animals from such areas in order to secure the nectar sources. The reporter witnessed in Kenya actual examples of such exclusion of animals practiced by certain farmers among those having adopted apiculture as an occupation for living.

4) Assistance for restoration of vegetation by enhanced pollination (pollinator therapy)

The activity of apiculture on its own increases the number of individual honey bees, and hence promotes the pollination by their intermediary visits, increases the seed production by plants of nectar sources and thus assists the acceleration of restoration of vegetation. Moreover, regarding a causal relationship with animal production, in areas where the grazing of goats constitutes an important occupation for living, the pods of leguminous plants such as Acacia species are often utilized as important forage[9] during the dry season, the factor which cannot be ignored because of the possible effect of insect pollination on productivity of pods.

9 In the vicinity of Kitui of Kenya, the pods of *Acacia tortilis* are sold as forage for animals during the dry season.

5) Reduced expansion of agricultural land

If sufficient cash income is generated by apiculture, the necessity for dependence on agricultural crops is reduced, and hence the necessity for expansion of agricultural land by felling and clearing natural forests diminishes. Under the current situation that the reduction of forests has become a continuous trend, this fact can be considered as an important activity of conservation in a different connotation.

6) Reduction of cutting down pressure (conversion from charcoal production)

Although it does not apply to all areas, in many parts of semi-arid regions in Africa, because of insufficient rainfalls, the crop productivity is low and the interval between rainy seasons is long. Consequently, at the time before and immediately after the beginning of the rainy season, farmers often run out of provisions and have to purchase food by cash. Many local residents lacking other means of earning cash, such as selling of animals, practice charcoal production around this time to raise the cash for purchasing food by selling the product to urban areas. If apiculture is introduced and cash is earned by the activity before the rainy season, the reduction of forests cut down by charcoal production can be expected.

Furthermore, among tree species used for charcoal production, there are many species which are particularly important as nectar sources, including *Acacia mellifera, A. tortilis, A. polyacantha, and A. seyal.* If apiculture can be introduced and developed in those areas where these species still remain, it is likely that many local residents would come to convert their attitude toward the forest trees, recognizing that they are the nectar sources and not the crude material for producing charcoal. Such conversion signifies a direct change of paradigm of exploitation of existing forest trees from utilization by cutting down to that by conservation.

Moreover, since certain Acacia species bloom before the beginning of the rainy season, if the introduction of apiculture enables beekeepers to harvest and sell

honey at this time, they will have the means to earn cash coincidentally with the financially difficult time before and after the beginning of the rainy season, presenting another direct solution for the problem of charcoal production. In such a context, apiculture is a very important activity for the conservation of natural environment.

Chapter 5 Industrialization and high quality production

5-1 Products of apiculture – 8 gifts from honey bees

Honey bees collect from plants nectar (mainly sugars) and pollen (nutrients other than sugar) as food, and resin and sap as materials to make propolis for building hives. Furthermore, royal jelly, a secretion from worker bees, beeswax, bee venom, and pupae of male bees as "infant bees" are utilized widely in the sector of api-therapy (therapy by honey bees). In addition, the utilization of pheromone and pollination can be said to be the honey bee products. Excepting pheromone which is not so commonly used, people often talk about 8 gifts from honey bees. Particularly the fact that all these products serve for the health of humans is noteworthy.

1) Honey

Although proportion may differ depending on the plant species of nectar sources, on average, honey contains water (20 %), glucose (35 %), fructose (40 %), and sucrose (a few %). Because the principal contents, glucose and fructose, do not need to be decomposed in the body and can be absorbed through intestines within about 20 minutes, the honey can be said to be an excellent food as energy source, and is reputed to be beneficial for invalids and suited for consumption after physical exercises.

Furthermore, mineral substances and organic acids contained as trace components make up the specific characteristics of each variety of honey. Those honeys with high contents of minerals tend to be generally in dark color, and those with high contents of organic acids tend to have a rich taste. The particular combination of these components creates so-called peculiarity of taste.

Honey has been valued highly as a sweetener since early times in human history, can be consumed as it is as table honey, and also as an ingredient for

preparing candies, conserved fruits, juices, cakes and cooked foods. It has a long history of a very wide range of utilization, including that as crude materials for processing mead, reputed to be the oldest wine in the world, and for making cosmetics.

Moreover, honey possesses a strong antibacterial property which not only makes itself resistant to decomposition but also has enabled it to be used as disinfectant for dressing external wounds and as preservative for storage of foods. Recently its strong medicinal effects for the treatment of grave skin diseases and external wounds have been reevaluated and medical appliances exclusively designed for its use have been developed. This situation is called the restoration of rights of honey in medical treatment. Furthermore, researches are in progress in which scientists expect to identify various effects out of it, including those of antiphlogistics, blood-forming medicines, and cellular stimulants, etc. In developing countries, honey is used as a household medicine for disinfecting slight external wounds or for supplementing carbohydrates by adding it to water supplied for caring the diarrhea caused by infectious diseases of digestive organs. For those purposes, even a very small-scale production of honey can be considered to be sufficient for satisfying the needs at household level.

2) Royal jelly

Royal jelly is a special kind of food that young worker bees of the age between 3 days and 13 days after emergence give to the queen bee and the larvae destined to become queen bees. The ingredients of royal jelly consist mainly of pollens gathered from flowers by workers. It is secreted based on nutrients that have been digested and decomposed in the body of workers, in which protein components are refined at hypopharyngeal glands and lipids (fatty acids) at mandibular glands. Contained sugars derive from those in honey sacs which have been mixed.

Although in natural conditions only a very small amount is produced, a technique to produce a large amount has been developed by exploiting the nature of honey bees that worker bees are eager to make queen bees when they are left without a queen bee or when they are isolated away from the space where the queen

bee is present. Formerly a royal cell made of beeswax was used, but nowadays mostly an artificial royal cell made of plastic (small cup with a diameter less than 10 mm) is used as a device to which a larva of worker bee (both queen bee and worker bees develop from fertilized eggs) of less than 3 days old after hatching is transferred (process is called "larva transfer") so that worker bees may be induced to nurse it just as they nurse a lava to make a queen. With this method, the introduced larva is removed 48 to 72 hours later and the royal jelly deposited at the bottom of artificial royal cell is harvested. The amount of the royal jelly collectable from one royal cell is very limited with only about 300 mg. The amount and the extent of acceptance of artificial royal cell by worker bees are largely influenced by the amount of pollens available at a particular time. A large amount of collected pollens constitutes also a favorable condition for the production of royal jelly.

On average, royal jelly contains water (66 %), carbohydrates (15 %), protein (11 %), lipids (7 %), and minerals (1 %), making up a highly nutritious food with well balanced contents of all nutrients, unlike honey consisting mainly of carbohydrates. In this regard, royal jelly can be used without processing as supplement food, and since it is highly valued for its good effects on health based on the knowledge about its physiologically active properties mainly related to protein contents, it is widely used as an auxiliary crude material in manufacturing diverse kinds of health food, and furthermore is added to cosmetic products as an ingredient having moisturizing effects.

While commercialized products are diverse, in Japan they are classified into 3 large groups, fresh royal jelly, dried royal jelly (lyophilized powder), and industrially processed royal jelly. Commercial production of royal jelly has reached the level of a significant sub-sector in apiculture in certain countries of the West and the Southeast Asia, but veritable results in Africa are almost nonexistent.

3) Propolis

Propolis is a resinous mixture that honey bees gather from plants and use for filling gaps in combs to protect the colony from the intrusion of external enemies and ward off the cold. It is a sticky solid material deriving from exudates secreted

by plants as defensive substances to protect new buds, new leaves and wounds which are collected by honey bees and mixed with their own secretions, presenting dark green to dark brown appearances.

Honey bees smear propolis on hive entrances, gaps between frames and hive box, and back of cover, etc. to keep the interior of hive clean to maintain health. That is to say, conceivably honey bees gather propolis in order to make the environment inside the hive suitable for their life by utilizing its stickiness and plasticity. Incidentally, the honey bee species which has the habit to gather the propolis is only the European honey bee among 9 species existing in the world, and the honey bees indigenous to

Asia including Japanese honey bee do not have the habit to utilize the propolis. And within European species, differences are observed among sub-species concerning the manner of utilization.

Propolis is known to have beneficial effects for human health maintenance, containing, as useful ingredients, components derived from plants, particularly groups of substances which present strong physiologically active effects, including flavonoids, terpenoids, and derivatives of cinnamic acid, etc. Only, since all the ingredients are derived from plants, they differ depending on the kinds of source plants that honey bees utilize in making propolis, and therefore in spite of a very large number of research results available, it should be noted that those effects or results reported cannot universally be attributable to all the propolis.

European honey bee species are known to utilize specific plant species as sources of propolis. In Europe, the varieties of propolis derived from poplar, white birch, alder, and willow have been recognized since early times. While information about the propolis produced in Africa is scarce, since the knowledge about the propolis made by honey bees utilizing indigenous plants will sometimes lead retroactively to the discoveries of new useful plant resources in local regions, it is highly advisable to be vigilant on this aspect of propolis in the areas where the extension of apiculture is possible.

4) Pollen

Honey bees visiting flowers make balls out of pollens on stamens, which they put into pollen baskets on hind legs, transport to hives, store in comb cells and use as food. By eating the pollens, worker bees also produce royal jelly.

Beekeepers install pollen collectors in front of hive entrances so that pollens can be collected by causing the pollens to be scraped off the hind legs when honey bees pass through holes only large enough to let them manage to get through. Pollens as they are are moist and gather fungi, and hence have to be dried immediately for conservation. The dried pollens also maintain the same granular form as that found on legs of honey bees, and many commercial products are offered in this state without further processing.

Effective ingredients differ depending on kinds of flowers but generally are highly nutritious ones, including amino acids of higher order (containing all the essential amino acids), vitamins, enzymes, glucose, fructose, etc. Pollens are said to be difficult to digest in human digestive organs unless hard cellular membranes are broken, and hence nowadays processed products with excellent efficiency for digestion are also commercialized.

In Japan royal jelly is more likely than not more popular as a health food, but in the West pollens are generally better known and often utilized as toppings on cereals.

5) Beeswax

A honey bee hive is made of beeswax which is secreted by honeybees, and the industrial product derived from it by melting it is particularly and commonly called “wax”. Beeswax is a resinous substance that honey bees synthesize in their body and secrete through 4 pairs of wax glands located on the ventral side of abdomen, and the principal ingredients are cerotic acid and myricyl palmitate, essentially solid esters of high polymers.

In primitive type of beekeeping, it is produced as a byproduct of honey production, and hence is basically a product with a long history of utilization just

like honey. It is no more a byproduct of honey production, but it used to be consumed in a large quantity as a crude material for manufacturing candles for religious functions in churches. So much so that at a certain time the principal objective of beekeeping was the production of beeswax.

Because of its hydrophobicity, it was smeared on ships or containers and also used for repairing broken containers. It is still used widely as a crude material for manufacturing candles in both the East and the West, being preferred for the merit that they emit less soot and have a better aroma compared with candles made of paraffin from petroleum. Currently it is also popularly used in the sector of handicrafts as coating agents, and for batik and wax molds. Since humans cannot digest beeswax, it has no significance in terms of nutritional value, but in food processing industry its utility is significant as desiccants for diverse kinds of food, or as coating material for fabrication of medicines like sugar-coated pills. Cosmetics industry is the largest market for beeswax, consuming it as base for creams and lipsticks, exploiting the specific characteristics of beeswax that it works for maintaining the form, increasing consistency, or making the main product ready to stick to objects. Other uses of beeswax include those for the base of pharmaceutical ointments, suppositories, crude materials for manufacturing traditional Chinese medicines, lubricants to reduce breaking of threads in textile industry, confectionery ingredients, and materials for dentistry. Furthermore, the crayons made from beeswax have merits that they produce clear colors, and because of high melting point they do not stain the hand easily.

Diverse areas of its use further extend to manufacturing of such products as those for finishing leather goods, insulation, wax paper, musical instruments, waxing materials for grafting, printing, fabrication of materials for casting molds, oils for anticorrosion and waterproofing, various kinds of greases, etc. In particular beeswax is used in diverse sectors of manufacturing industry as the agent to facilitate the separation of molds from cast products, where there is no efficient substitute to replace beeswax, the situation which is creating a strong demand even in the manufacturing process of electronic parts in high technology.

Beeswax is derived from melted substances collected from honeycombs, brace combs, and honey caps. Although often it is confused with propolis, it is a different

product with completely different ingredients. Since propolis is smeared also on comb cells, aged honeycombs appear dark and the value of the beeswax made by melting them is also low. On the contrary, the beeswax collected from brace combs and honey caps contains few impurities, showing a shade of yellow, and produces wax of good quality. Consequently, it is needed to melt separately the two components when wax is made, to see to it that they are not mixed up.

Regarding the methods of processing wax, there is the one by heating-compressing with the heat generated by gas or firewood, and the other by solar heat wax processing. The processing method by melting comb materials with solar heat accumulated in a hand-made wooden box which is lined with aluminum sheets on the inner wall and covered with a glass panel is recommendable in view of the location of Kenya rich with solar energy as well as from the viewpoint of ecology. In this case, if melted material is passed through a wire netting of meshes of 2 to 3 mm, it will filter out gross impurities other than wax and enable the collection of wax of good quality. The state of product at this stage is called “wax”, and when it is further refined and bleached, the white to yellow-tinted “bleached wax” is produced. As bleaching process, there are 3 methods: the solar bleaching which uses ultraviolet rays of sunlight, adsorption/filtering bleaching by such materials as activated carbon, and chemical bleaching by a bleaching agent.

The main compounds constituting beeswax of European honey bees are: esters combining higher fatty acids and higher alcohols with a content of approximately 70 %; free fatty acids (approx. 15 %); free alcohol (1 to 2 %); hydrocarbons (13 %); and a certain amount of glycerides. Other physical properties are: specific gravity, around 0.85; melting point, 65℃; acid number, AV 5 to 22; iodine number, IV 5 to 15; saponification number, SV 80 to 100. Beeswax produced in Africa is highly appreciated for the reputation that it possesses better qualities usable for many purposes, compared with the product from Asia.

6) Larvae of bees

Pupae of male honey bees (recently including larvae of queen bees as byproduct of royal jelly production) are consumed as a delicacy food and a health

food. It is said that they contain a very high level of amino acids (certain results of analyses show contents of around 40 %) and are rich with other nutrients, including vitamins and minerals like phosphor, calcium, iron and zinc.

In China larvae of bees have been consumed as a food since early times and actually were described in the book of Materia Medica, "Shen-Nung Pen-Ts'ao", ca. 500 A.D., in which they were classed as one of the superior medicines and noted as "they are effective for curing various ailments by removing causes, and habitual consumption is beneficial for improving general health status physical as well as spiritual of humans".

As a health food, a capsulated freeze-dried product is sold commercially and the demand for it is increasing recently.

Furthermore, dehydrated powder (powder of larvae of male bees) is known to be effective for rearing ladybirds and lacewings as natural enemies applicable for agricultural purposes.

7) Bee venom

Honey bees possess a stinger and use it as the only arm against harmful enemies. Its venom contains amines like histamine, enzymes like melitin and phospholipase, and apamine as a nerve toxin. These venom components, as they are, are physiologically active substances effective for human body. In Japan since ancient times a medical treatment utilizing honey bee stingers (with venom) has been practiced as the bee stinger cure. In Germany and Rumania, by means of an apparatus which can extract bee venom only, it is used as a material for making medicines like ointments.

Apitherapy, with the concept that bee products are to be used for human health, originally in a narrower sense of the term, signified the cure with bee venom. It is mainly effective for those illnesses which are difficult to cure by modern medical treatments such as arthritis and rheumatism, establishing a place in the domain of health care as an alternative method of treatment.

The risks associated with bee venom treatments essentially concerns the

allergic reaction to bee venom, and hence currently clinical researches are going on to characterize general as well as harmful reactions to bee venom.

There are actual cases of application of apitherapy concept contributing to the health enhancement of local residents in developing countries: the representatives of the apitherapy committee of the International Conference of Apiculture have established apitherapy sanatoria in Cuba and Burkina Faso to help people by utilizing not only the bee venom but also various products of honey bees.

8) Pollination

Although, strictly speaking, it is inappropriate to treat the element of pollination as a product of apiculture, it constitutes an essential part in the efforts of apiculture development in developing countries to have the importance of its function well understood by the people concerned. Moreover, since, in the apiculture sector, pollinator bees or the queen bees which are reared for breeding colonies of pollinator bees are propagated and sold commercially, the colonies of honey bees and queen bees on their own can be regarded as products.

Because the visits of honey bees effect pollination of flowers of crop plants, they are introduced in many countries for the production of fruits, vegetables and seeds of forage crops. In Japan, honey bees are utilized at a high rate in the horticultural production in green houses like the cases of growing of strawberry and melons in plastic houses. They are also used extensively in zones growing fruit trees like cherry and apple where many honey bee hives are installed during the bloom.

The economic impact due to increased production of agricultural crops through the fruiting promoted by the pollination effected by visits of honey bees is very much substantial and its magnitude is reputed to be larger than from 30 to 100 times as much as the scale of total combined production of apiculture including honey and all other products.

The development of beekeeping specialized in pollination of crops may be feasible also in developing countries, but regrettably it can be admitted that the contribution by honey bees in the productivity improvement of agricultural crops is

not always understood well even in industrialized countries. Since the honey bee is an insect susceptible to pesticide effects, the utilization of honey bees essentially has a potential to be a factor leading to the reduction of chemicals, but in reality such a case is still rare. However, in the future the scenario will presumably take a very important position.

And above all the largest product of apiculture is the fact that, while on one hand it provides products like honey, it is, on the other hand, contributing not only to the conservation of ecosystem on agricultural lands but also to that of natural ecosystem, without inflicting destruction on the global environment.

5-2 High quality production

In the present-day context, the production “with high quality” in apiculture is not necessarily the output from a system of high technical level. In the case of honey, impurities present are fewer in the honey obtained by compressing only the combs filled with honey which beekeepers selectively take out from top bar hives than in the one obtained by compressing the entire combs in hives collected by the method resembling traditional honey hunting, and the impurities get still fewer in the product harvested from modern bee hives with frames in which a centrifuge can be utilized for extraction. Regarding the production of mono-floral honey (that from flowers of a single plant species) in which honey harvesting is repeated within a short period, without modern beekeeping technology, the honey of high quality in that sense cannot be obtained. On the other hand, in modern beekeeping the incidences of various diseases and parasitic mites often create problems. While in many countries chemical agents are used for prevention and treatment, the problems due to the residues of these substances do not occur in the case of traditional beekeeping which can ill afford the application of these chemicals.

Regarding the production of beeswax, because combs are used for a long period, and miticides applied in hives easily infiltrate beeswax and accumulate in it, presumably the products from traditional systems are superior in the level of quality. The absence of contamination with chemicals or their residues is an important essential quality of products from the viewpoint of quality, and in this respect it is an indicator of high quality. Considering that many products of honey are classified as health foods and that non-food beeswax also is used extensively as a raw material for manufacturing foods and cosmetics, it is revealed that the factor which impairs the quality most significantly is the residues of intentionally used chemicals rather than simple impurities of no harm. Consequently it is known that the modernization of production techniques does not necessarily leads to the production of products of high quality.

To be sure the technical level of apiculture in developing countries is often low from the viewpoint of efficiency of investment, but if one applies the criteria of

product quality, the project in such countries does not always stand at a disadvantaged position. When one can evaluate relevantly the product that is the output of production activities, without questioning their external form, the beekeeping aiming at high quality products in developing countries has great potential.

Chapter 6　Business model of community trade

6-1　Community trade

In this chapter I would like to examine the question of "apiculture development in developing countries", from the angle of a marketer as well as from the viewpoint of marketing. Consequently, the manner of treatment of subject may be somewhat fuzzy, which I would like to ask readers to tolerate and complement by referring to other chapters and sections for detailed information. Incidentally, since the present reporter is a business person with the occupation of distribution, it would be inevitable to take the view of pursuing business potential for which also the understanding of readers is sincerely requested.

6-1-1　What is community trade?

It is only since the "Project of development of shea butter industry in West Africa" implemented by JETRO in 2005 that I have been provided with an opportunity to participate in a project in the framework of official development assistance (ODA). The objective of the project was to conduct field surveys covering Nigeria and Ghana in order to draft a proposition concerning the potential of shea butter industry.

As far as I am aware, business, let alone trade, has been and has had to be something fair and equitable since ancient times when people practiced barter. Accordingly, I tried to find a phrase better than commonly used "fair trade", in the activity report and at the debriefing session on the shea butter project, and proposed the new phrase, "community trade".

＊ The time is passing. The point remarked in Fair Trade "From now on let's trade with the spirit of reciprocity" is now developing to "Let's solve the

community problems through trade".

It may have been otherwise in the remote antiquities when human existence was based on hunting and gathering, but humans have always made livelihood by running one kind of "business" or another. Considering the matter in this way, let's advance the argument forward.

Here I am going to assess the state of market of Japan, one of the major consuming and industrialized countries of the world, from the viewpoint of marketing. The reason for it is because business is the matter of balance between supply and demand. In other word, unless there is demand, no supply can exist and is necessary. Although one uses the term "balance of demand-supply", the fact is that no supply is possible without demand. Key word is business. There is another important aspect. It is the verification of development stage of people. Because all that matters is the fact that the human action taken vis-à-vis other person is business.

6-1-2 Marketing analysis of the Japanese market

Japan has come behind the early industrialized countries in the West. It has tried to westernize itself and has made single-minded efforts to catch up with and get ahead of Western countries. Heavy industries playing the role of locomotive followed by light industries, and after passing through the high economic growth, it has managed to enter the club of major industrialized countries of the world. Lately people are certainly enjoying at least the material richness. A view maintains that material richness is not what counts, but that is not our subject, so let's advance forward…… It is simple to dismiss the material richness and end the argument, but I think that the material wealth actually constitutes the fundamental motive to enable humans to develop. Very few people can live without wants like saints or more perfectly like a legendary wizard, and the majority of people would be able to become developed only after experiencing the processes that Japanese people have gone through. So far, Japanese people have pursued material civilization revolving

around goods. Owing to a quality to be proud of and rarely found in the world, that 80 % of general public consider themselves as belonging to the middle class, they all together have got wealthy, but all what they have done is a lifestyle seeking to have a set of goods. And now people want to rest a little and seek spiritual healing which has become a fad.

What comes next? I suppose that the development revolving around material goods cannot be expected so much. The developing stage continues further in the future as well. Only the dimension of development would differ. Shifting from the dimension of development so far, people would advance to other dimension to seek the next process of development. No, it is also thought to have already started. .

6-1-3 Analysis of business and distribution stages

In this section, I would like to consider the business out of the 2 factors pointed out at the end of section 6-1-1.

・Supply and demand

As stated previously, business is the matter of demand and supply. What they call the state of equilibrium between demand and supply is the market which is generally referred to as a formed market.

・Stages of distribution and the structure of profits

Please observe the schema below.

Manufacturer (25~30) —— wholesaler at production site (40~45) —— wholesaler at consuming sites (50~55) —— retailer (60~65) —— general consumers (100)

This roughly shows a typical flow of distribution. Analysis of this flow can be made as follows:

Elements are: manufacturer (production) – wholesaler at the production site (collection, shipping to wholesaler at consuming sites) - wholesaler at consuming sites (collection and shipping to retailer)- retailer (display and vending). Of course, prices differ depending on stages of distribution. In the example shown, cases with sundries were assumed and the details are as follows: a retailer purchases for 60 to 65 yen an article which general consumers buy for 100 yen, earning hence a gross margin of 35 to 40 yen; both the wholesaler at production site and the one at consuming site earn a margin of 10 to 15 yen because they deal with a large quantity but only collect and deliver the merchandise; manufacturer makes an effort to be able to realize profits at that price. The distribution industry has been operating under such structure so far, but circumstances are changing rapidly. That is what they call the notion of exclusion of wholesalers or that of non-utility of wholesalers. Why? Here come the home delivery services. The rapid expansion of home delivery services has transformed drastically the stages of distribution. The business logistics which used to depend uniquely on freight services by rail or long hauling trucks have changed and been innovated. Goods are delivered to consumers from producers on the following day of the order.

・Complex industry, new business model

Industrial activities are classified into different stages. They are so-called primary industry (agriculture, forestry and fisheries, and mining), secondary industry (manufacturing), and tertiary industry (marketing and services industry). (Certain views also propose the fourth category for educational industry and the fifth for health industry.)

Many of goods and services are delivered to general consumers after passing through these stages. These processes are called distribution, where a class of tertiary industry that is situated the closest to final consumers and practices

retailing is mainly called the distribution industry, and the realizable added value increases normally as the stage of industry advances from the primary through the secondary to the tertiary. In those days when in Japan commodities were lacking and heavy and big industries were at the height of their prosperity, the primary sector held a dominant position in the determining of prices, but nowadays when commodities are abundant and light and small manufacturing and service industries are flourishing, the power of pricing is shifting to the tertiary side.

Probably perceiving this trend, in the sector of apparel merchandising already a new type of operation has appeared and is thriving. (A type of operation implies a new mechanism, a new framework and a new approach, without limiting the scope of operation in a single specialized occupation like butcher, fishmonger, or grocery, which is typically represented by the cases of super markets and convenience stores.)

The type of operation cited is called SPA (specialty store retailer of private apparel), a mode of conducting business integrating vertically all processes extending from manufacturing to retailing, that is, a new business model of manufacturing-retailing. The trendsetter enterprises are represented by GAP, etc. Taking into consideration these phenomena together, it is deduced that the business is best organized by seizing in a complex context all stages of industrial category, namely, combining primary, secondary and tertiary industries together to integrate all into a single entity (I propose to call it complex industry). In order to be on the winning side, there is always an essential point.

6-1-4 Marketing for community trade

So far I have stated only generalities; now I would like to argue in more specific terms.

- **Business in late participating and developing countries**

Probably there should be many of the industries which are infinitesimally close to primary category. This situation is quite well understandable and cannot be helped, but I would like to ask you to consider them in a perspective of the complex industry as described in the preceding section. Raw materials are available but their sales as they are will generate only limited profits. The issue is how to add more value to them. Processing is the key. Raw materials have to be processed from primary products to secondary products. In addition, their qualities have to be raised to reach the level demanded by Japanese market. Because the grade of quality that is accepted by Japanese market which is known to be the one of the most selective for quality in the world can also be accepted by markets all over the world.

- **Appeal to mind**

Since about 20 years ago, I have always been conscious principally of the importance of creation of matters, by concocting a motto "From material to matter, then to mind". It was inspired by an assumed principle of marketing that human being will seek for matters once he become affluent with materials. Fortunately, the world progressed in that direction, and the assumption has not turned out to be irrelevant, and now I am strongly conscious of the next phase that concerns mind. I am complacent of having added the words "then to mind" to the motto. The age of that phase is in sight; or rather I should say that it has already started. When I was looking at pieces of soap made in Ghana in the shop, the brand which a shopper happened to choose was one made in Ghana out of those displayed together with products made by the Japanese or the Americans. At that moment, I felt keenly that the product interacted with the client in the sphere of mind. That's it. To be sure, what is important is the mind. The client is aware of the existence of producers. Here is hidden a clue. That does not suggest demanding compassion. It is a matter of a story. Those who are seriously exerting the best efforts can always find many supporters. This aspect of the matter is a great merit and has to be utilized to the maximum advantage.

- **4 most important elements of business**

It is said that men, material, money, and information constitute the 4 principal elements of business. Setting money aside, important are men, material and information. Let assume that men don't make much difference. I think that men are all alike and the thing other men can do can be done by anyone. Anyone, if he is taught, understands, and tries to do a thing, he can accomplish it. Only there could be the difference in speed of action or that of whether he accomplishes it skillfully or badly. If the factor of men works like that, the rest which counts is material. How to make it, how to process it, what kind of product to make, and how to combine available materials……it is the question of creative thinking.

The essence of marketing is "who delivers how what product to whom by making one feel how?" And information should not be neglected either. It is essential to know well the market, the sector, and the world.

6-1-5 Exploring the potential of beekeeping business

While it is said that the number of effects realizable by beekeeping is 8, that of such effects treated as factors of business may be about 5. They are honey, royal jelly, propolis, pollens and wax (beeswax). I believe that the wax is the very product that has the potential to be able to make business in the international arena. Honey has a saturated market, and hence it is difficult for it to enter the world market, unless it has certain highly differentiating characteristics (such as particularity and characteristics of flowers of nectar sources). Royal jelly, propolis and pollens also have already established markets and would require equipment and technology of an advanced level to process them into salable products. Under the circumstances, beeswax still holds a promise for profits.

Beeswax is employed in unexpected products like cosmetics, capsules for medical purposes, CD, forming of foods, building materials for preventing sick house syndromes, etc., but, to go back to the real roots, since ancient times it has

been used essentially for making candles throughout the world. Candles, namely, beeswax candles! I found during the visit to Kenya this time that there were hardly any cases of utilization of beeswax. Furthermore, even when beekeepers sell it to wholesalers, the prices are reportedly at best one fifth of those for honey. In certain cases, it was given out to merchants for nothing. What a waste, indeed!.

Incidentally I hear that about 2,800 ton of honey and 4 ton of beeswax are harvested yearly in Japan. This means that in Kenya, the amount of beeswax of 10 times as much as the current production or more should be able to be produced. The material is there!

There comes the business. The commercialization of material itself, i.e. beeswax, has also a potential. According to the information provided by a Japanese workshop of candles, the domestic products are sold for more than 1,500 yen per kg, and imported beeswax from Tasmania costs between 2,000 and 2,600 yen per kg, depending on degrees of refinement. Don't throw it away! It should be harvested and sold. But simple sale of the material is not yet enough. Business should be conceived as a complex industry. Beeswax has to be harvested and made into candles within a business unit. Because certain beekeepers are said to go to markets to buy candles, it could be expected that beekeepers can make them not only for their own use but also for selling to cater to the demand of domestic market. If the products are candles of 100 % pure beeswax, the world market is waiting for it. The markets will be those of the West, and the Japanese one as well. Particularly in Japan in recent years, candles have become from seasonal merchandise catering to Christmastide demand to standard articles consumed throughout the year by those seeking healing experience and by young women. Besides, they can be made manually, and more than anything else, required equipment is insignificant. Think in terms of complex industry model to add value to the product!

6-1-6 Making beeswax candles from beehives

＊ Refined wax

Honey bees construct new combs not only on frames in a hive cavity but also on external parts and in casually found gaps. Moreover, they close cells with caps composed of wax when they are filled with plenty of honey for conservation. Harvesting of honey is carried out by removing those "honey caps" with a knife and then centrifuging the entire honeycombs. Harvested and refined materials from remnants and disused combs make "beeswax".

From 1,000 g of combs, about 700 g of beeswax is produced.

＊ Method for obtaining beeswax suitable for making candles

Color of honeycomb;

Color of honeycombs varies depending on seasons, locations, and flowers. The reason for the variation is due to the color of pollens dissolved in the nectar taken by honey bees. Moreover, old honeycombs are turbid and blackish in color, and hence not suited for use as beeswax. Color and aroma vary according to locations, kinds of flowers and seasons, but the variation is also the characteristics of beeswax.

＊ Process of filtering

Beeswax has a high viscosity and is hence difficult to filter with cloth of fine meshes. If the powdery remnants of honeycombs are present in candles, they will block the flow of melted wax through a wick, and prevent smooth flaming.

Melting – remove gross scraps by filtering with a screen with meshes of the size of a tea strainer – the primary filtering with cloth like linen – the secondary filtering with cloth of a type of gauze with a little bit finer meshes – collection after waiting for the sedimentation of powdery components like pollens – hardening. (Alternatively harden the entire material together with sediments and scrape them off after taking out the hardened mass out of the container.)

＊ **Method of melting**

Cases of treating a small amount (around 5 kg) of refined wax

＊ **Apparatus for making wax by solar heat**

Inexpensive apparatus which makes beeswax by the solar heat outdoors by throwing in scraps of honeycombs at all time. If it is covered with wire netting, contamination with rubbish is relatively lessened. Accumulated beeswax is melted as it is and filtered.

＊ **Boiling the material in a large quantity of water for melting**

Impurities are dissolved and deposited in hot water, facilitating the filtering.

However, after waiting for solidification to separate beeswax from the mixture and dehydrate it, the process passes to further melting once more to filter the product, necessitating the expenditure for more fuel and time.

＊ **Cases of treating a large quantity**

Honeycombs are put into a large pot and heated directly on a gas burner and melted. Large quantities of rubbish and residue are produced and have to be separated by squeezing by putting them in filter bags which are compressed by a pressing machine like the one shown in the picture below.

Compressing can minimize the loss. Subsequent filtering is carried out through the normal procedures, but due to compressing, products contain a little bit more of

fine deposits.

＊ Basic materials for candle making

・Case of use of molds

Polycarbonate molds　　Aluminum molds　　Stainless steel molds

Ready-made molds are available with diameters of 2 inches (about 5 cm) and upward, but those with smaller diameters have to be fabricated. Acrylic pipes are available in increments by 10 mm.

・Wicks

A thick and strong type of wick that is called square braid wick is normally used for making beeswax candles. Square braid wick is designed so that it can suck up efficiently the wax of high viscosity by surface tension and also tolerate the higher combustion temperature compared with that of paraffin candles.

＜Combustion test of wicks＞

The thickness of wicks of candles varies depending on candle diameters and forms, or the properties of wax.

Since combustion varies depending on room temperatures and air circulation due to air conditioning facilities, certain standard conditions are maintained for repeated combustion tests to determine the optimum thickness of wicks.

Wicks

Cut wicks

Washers

・Washer

Washer is a device to keep a wick in place at the center. It enables a wick to burn until it comes to the end without falling down. It is used also for extinguishing the flame safely. The limited bore of 2 mm cannot accommodate wicks thicker than that specification.

・Mold lubricant

The interior surfaces of molds are smeared with lubricant to facilitate the separation of cast products. Without applying this, candles cannot be extracted from molds. Any kinds of vegetable oil (salad oil, for example) can be used.

・Additive oil

Combustion efficiency of beeswax candles improves by oxidation. Assuming that the beeswax is used immediately after refining, it is recommended to use additive oil, because the oxidation is accelerated by the addition.

Moreover, it will lower the viscosity, making the beeswax more malleable for processing.

Generally oils like that of macadamia are used, but local products can be used as well unless they modify aroma. This can be dispensed with. In that case no extra cost will accrue, and besides the claim of 100 % pure beeswax can be justified.

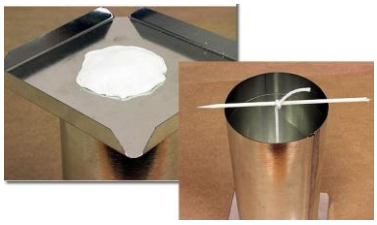
＊ **Tools for candle making -** When natural cooling at room temperature is assumed

・ Stand for melting and keeping warm of beeswax. Stand for pouring in. Stand

for cooling and hardening.

- Stand for trimming and conduction of wicks. Stand for packaging for commercialization. Shelves for storage. (If possible, these tools are most desirably installed in another cool and shaded room. High room temperatures soften beeswax, making it easily stick to fingers, and candles become fused one another, making it difficult to finish the products.)
- Molds, wicks, gas appliance, large hot plate, deep pan, shallow pan, large ladle (in stainless), beakers (1000 ml, 500ml. White enameled beakers are preferable for enabling better visibility of colors and impurities.)
- Thermometer (100℃) , vegetable oil (mold lubricant) , tool to smear molds with oil, pincers.
- Scissors, cutter blades, cooking timer, waste cloth (plenty) for cleaning pans and beakers
- Work gloves, scraper, packing tape, etc.

＊ Candle making by using molds



＜Determination of size＞

i) Conforming to ready-made molds (specifications such as diameter and height are fixed.)

ii) Making molds (molds for pillar type products can be fabricated from pipes of

vinyl chloride or acrylics)

＜Selection of the face of mold that will make the top face of product＞

i) Selection of the bottom face of mold as the top face of product – the finishing of the top face of mold needs not be elaborate so much, because it corresponds to the bottom face of product.

ii) Selection of the top face of mold as the top face of product — although the manner of fixation of wicks makes difference, if a rod is inserted, a candle arousing a sense of handicrafts is produced.

＜Determining how to fix wicks＞

i) Fixing directly on mold

After introducing a wick into a mold, it is needed to close gaps by puttying or sticking packing tape to prevent the leak of melted wax, a process requiring considerable time in mass production.

ii) Installation of a metal rod.

A metal rod with a diameter corresponding to wick thickness is installed in advance on the mold before melted wax is poured into. It is extracted after wax cools off and gets hardened. A wick with washer is inserted into the formed bore.

＜Fabrication procedures＞

Smear mold lubricant on interior surface. (A vegetable oil will do.)

↓

Install the wick impregnated with wax

↓

Pour into the mold melted wax (about 80℃, variable depending on room temperature, though)

↓

As the surface sags down, bore a hole there and pour in more wax (several times depending on diameter and height).

↓

After hardening, extract product out of mold.

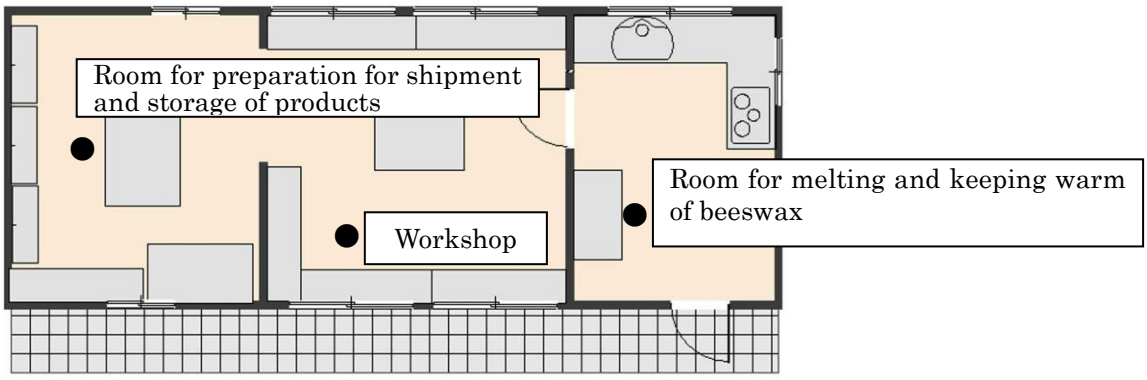
↓

Wipe off oil from the surface, after trimming, pack the product.

When beeswax is melted, bees and insects, sometimes bears, swarm about. Bears aside, screen doors are needed.

Because of high viscosity, once beeswax gathers dust, it does not come off. The maintenance of workshop cleanliness is important.

＊ An example of suggested layout of candle workshop



＜Room for melting and keeping warm of beeswax＞

・Natural cooling under room temperature is assumed.

・In order not to raise room temperature, it is preferable to melt the wax outdoors or in a different room (beware of insects when it is done outdoors.)

・Keeping warm could also be better accomplished in a different room rather than in the workshop.

Workshop room is equipped with stand for pouring, that for cooling, and that for fixing wicks. Candles extracted from molds are left on the stand for cooling for 24 hours to harden.

In the room for preparation for shipment and storage of products, candles made on previous day are inspected, packed and put into storage shelves. The surrounding of storage shelves is covered with black cloth with good aeration to prevent exposure to ultraviolet rays. Beeswax is susceptible to ultraviolet rays and if exposed, the quality deteriorates by loosing colors. Cool and shaded environment is desirable.

6-1-7 Method for making taper candle by hand dipping

As methods for making candles, in addition to the previously descried one by molding, there is one by manual rolling, but the most traditional and simple method is that by hand dipping. This is the origin of candle making and has been practiced since ancient times all over the world. This method requires only a few pieces of equipment and little cost.

The method consists of simple repetitions of dipping of wicks in melted wax to let them grow in size. Because it is handmade, the product assumes a natural tapered form of the Western style which the method by molding cannot duplicate. However, the commercialized holders of taper candles seem to be standardized, for an unknown reason, internationally for the size of insertion slot to be fixed at 22 mm, and hence it is needed to adapt the base to fit to this dimension. Besides, the depth of containers for melting wax needs to be greater than the length of candles.

Because beeswax is relatively soft, if candles are kept in a horizontal position during storage, they are liable to warp. It is recommended to make them in a pair forming a loop, so that they can be stored in a hanging position. The same precaution would be needed in marketing processes.






I have attempted to make candles by using the beeswax acquired during the survey in Kenya by hand dipping procedures. Seeing the results of actual fabrication, the craftsman of workshop in Japan expressed a view that the beeswax of Kenya was a genuine natural material of excellent quality, and asserted that this was a kind of product people would wish to buy, and gave his assurance that it would sell without fail. Finished candles retained the strong aroma of honey and appeared to be a high grade product. Incidentally, for that trial fabrication, the dipping process was repeated 29 times and the base of candles was made to grow to 22 mm.

The top ends of a pair of wicks are fixed to a support bar and their lower ends are connected to a heavy object. Suspended from the top support bar held by hands, each pair of wicks is dipped once at a time into melted beeswax in the melting pot. Wicks are immersed quickly but lifted relatively slowly. They are arranged and suspended on a cooling and drying rack of simple construction as shown in the

picture. Dipping is repeated in sequence. Drying for 24 hours will almost accomplish hardening, but it would require about a week of drying for obtaining the product ready for shipping.



6-1-8 Proposals for the apiculture development in Kenya

The above sections have only described a rough report of reporter's study of the subject matter, presenting facts, observations, and suggestions for further development from the viewpoint of marketing vis-à-vis the keynote theme "Development of beekeeping in developing countries and practical procedures – Case study in Africa –". Essential point is the need to gain the wealth through conducting business, by following the steps of progressive development of human society. In order to accomplish the development, there would be no other choice but to work and work really very hard. An old Japanese saying wisely put it in a phrase "Poverty is a stranger to industry" or "A hard worker will never know poverty". I really believe that the firstly important thing is to seek to earn income. The key to earning income is the added value. In our subject matter, the opportunity for added value could be found in the materials and byproducts from among products of apiculture that are not being exploited currently. No new costs will be required for fixture, and the markets are ready to accept the products. I eagerly wish that people would try it, the project of hand-made beeswax candles, by all means.

In order to succeed in the project, one of the essential 4 elements of business, namely, the information is needed. Japan has been implementing many development aid projects. I believe that Japan should emphasize the provision of

information in the aid projects in future. Regarding the target level of assistance, it is desirable to identify the relevant assistance measures and the relevant programs of provision of assistance equipment, by accurately assessing the present stage of development of the beneficiary society, through the reflection on historical stages of development that Japan experienced in the past.

In conclusion, I have gained insight on the matter in my own way. In any efforts for accomplishing something, one has to have an appropriate partner or counterpart. I came across one NGO called SITE. In my perception, the organization seems to be ready for making a partner for starting a project of community trade. For this time, I have got little knowledge about the existence of similar organizations, but there could be other ones. I am imagining a scenario to create a case of business based on the beekeeping that humans have been practicing since 5,000 years ago, in order to exploit it for the development of local communities. And I am thrilled at thinking of helping through it also the development of Kenya.

6-2 Practical procedures for export and import of honey bee products

Not only in Kenya but also in any other countries, when one tries to export honey bee products to Japan or other countries, the first problem concerns their quality. Particularly when the product is imported for the first time, the inspection at the exporting country is the most important step. In this section the practical procedures relevant to export and import are discussed, focusing on two commodities, honey and beeswax.

Regarding Kenya, among honey bee products, the possibility of export and import is believed to be limited only to honey and beeswax. Regarding the honey also, similarly to the cases of propolis and pollens, although it may have the possibility of being established as brand products depending on future development, the quality is greatly influenced by the difference in source plant species.

Other honey bee products, royal jelly and bee venom, are not produced currently. Moreover, because the import of honey bees and queen bees as those of breeding stock is prohibited, they are not taken into consideration.

1) Practice of inspection of honey

If the commodity in question is honey, firstly it has to be inspected for “taste”, “aroma”, and “color” by one’s own sensory organs, eye, nose, and tongue.

Because honey is a natural product, it is a normal situation that the quality differs among different containers, and therefore a sensory test has to be conducted for each of different containers. In such a case, it is desirable to perform the test after stirring well the contents to make them homogeneous as much as possible. When a large number of products have to be tested, care has to be taken to wash the mouth with water after spewing out the previously tasted sample every time a new test is carried out. Unless this procedure is followed, the senses of taste and smell are benumbed, becoming unable to distinguish differences in flavor and aroma.

When a large number of containers contain honey of an identical color, an identical aroma and an identical flavor, it does not mean that the quality is uniform, but it is the evidence that the honey was processed in a large lot by blending in a tank. In such a case, attention has to be paid as there is a likelihood that raw materials of honey with a low sugar content has been processed for condensation by heating.

The sensory test by tasting is undertaken for a small lot (generally of an oil drum). In the cases of monofloral honeys, while it is needed to remember the specific characteristics of honey from a particular kind of flower, because they are the sort of criteria that cannot be quantified numerically, the testing requires a great deal of skill. In particular, since the most important element of honey is the flavors pervading the whole mouth, and aromatic compounds are different depending on kinds of flowers, the testers are required to distinguish subtle differences of the taste.

Those honeys which smell of fermentation or taste sour due to fermentation have to be excluded. The honeys of low sugar contents start alcoholic fermentation due to the action of enzymes in honey, but there will be no problem for those in which the sugar content is proved to exceed 78 % by the reading of a sugar hydrometer. (Depending on the kinds of flowers, certain honeys are by nature characterized by the presence of sourness in flavors.)

Moreover, in the cases of honeys which smell of caramel and lack the flavors otherwise pervading the whole mouth, it is likely that they have undergone a process of condensation by heating in the decompressed kettle. This is caused by the fact that the aromatic compounds making the honey to taste good are sucked out together with water vapor in the process of decompression.

Regarding the testing of hue, since the color grade differs depending on the plants of nectar source, it is required to verify that the hue of examined honey is within the range of color grade associated with a specific kind of flower. In those honeys which have been stored for a long period, or have been treated with heat, HMF (hydroxyl-methyl-furfural) content increases and the hue turns to brownish color.

The above paragraphs have described the procedures of sensory tests on

monofloral honeys, but so far as the honeys from Kenya are concerned, it would be needed to start from the work of identification of plants from which they are derived. Moreover in the traditional system of beekeeping employing log beehives, the separation of monofloral honeys is essentially impossible to accomplish, and hence most of the honeys circulating on the market in Kenya are considered to be those collected non-selectively from nectar sources of diverse plant species. In such cases, since the color grade may not matter at all and the sensory tests also involve very complex factors, it is expected that the most important matter in quality assessment would be simply to determine the most fundamental properties of honey, namely, the extent of contamination with foreign matters, the sugar content, and the presence or absence of fermentation.

Incidentally, in order to satisfy the requirements of traceability, it is needed to attach to every lot of products a label indicating parameters: the name of producer; location of production; the date of production; names of plants of nectar source; and lot number.

At any rate, when the business of export and import is considered, since the standards set for honey products differ depending on individual importing countries, the honey for export has to comply with each item of imposed requirements. Moreover, the business of export has no chance of success, unless it can supply the products of correct quality adapted to a particular market, by precisely assessing the preference of the target country of consumption.

The products that have solved the above mentioned problems need to be verified with respect to their quality of safety. Principally the residues of antibiotics and agricultural chemicals have to be tested at the testing institutions. Although these substances are not yet problematic factors in Kenya, if modern beekeeping technology is extended in the future, presumably they will make problems which cannot be passed by. Product samples need to be sent from Kenya to Japan beforehand to carry out tests at the testing institutions in Japan to determine the residues of antibiotics and agricultural chemicals. Incidentally, currently in Japan (as of January 2009) no antibiotic except mirosamycin (*Apiten*) or no miticide except fluvalinate (*Apistan*) is permitted to be used, and the allowable maximum content of residue is 0.05 ppm for mirosamycin and 0.05 ppm for fluvalinate. For other

substances, please refer to the list of permissible limits of residues for agricultural chemicals, veterinary products, and feed additives (see the the web site below). Moreover, particular attention needs to be paid to the requirement that no amount of substances such as chloramphenicol, nitrofuran, or coumaphos, which are likely to be used in beekeeping, is permitted to be detected, even if the content is a trace.

The Japan Food Chemical Research Institute

Positive List System of Agricultural Chemical Residues in Foods

http://www.ffcr.or.jp/zaidan/FFCRHOME.nsf/pages/MRLs-p

2) Beeswax

Crude beeswax made by beekeepers by melting brace combs, honey caps and old disused honeycombs presents no definite color, showing a range of variable hues, from light yellow, yellow, orange, brown, maroon, to dark brown. Fresh beeswax immediately after it is secreted from wax glands in abdomen of bees is transparent and colorless, but upon contact with air it soon gets hardened and makes thin pearl-like laminas. Even in the case where beeswax is made from newly built combs, it is colored with a yellowish hue because the color of pollens attached to bodies of bees is dissolved in it. Consequently, the color of beeswax varies also according to the kinds of flowers which bloom in particular seasons when the combs are built.

Old honeycombs which have been used many times by honey bees become darker in color as they get older, and the crude beeswax which is produced from such combs as raw materials contains more of impurities, showing brown to dark brown color. Naturally, products of clear colors are traded for higher prices.

With respect to export and import of beeswax, the rating of quality according to color grades seems to be undertaken by individual traders by themselves, and there is neither any international nor any criteria of Japan for this quality factor. Although the price ought to vary greatly by the color grade, it is determined by the final objective of use and the relevance of the price.

In the current situation in Kenya, the harvesting of honey is realized by the traditional system in which log hive is used to make wild honey bee colonies to settle it and then the entire honeycombs is compressed to extract honey. Consequently, the quantity of collected beeswax is larger than that obtained from the modern system using movable comb frames, and the pollution of antibiotics and chemicals used for the modern system is almost non-existent, which provides a great advantage for the export of beeswax of Kenya. In this respect, as long as beeswax is mainly used to make products associated with foods, cosmetics and medicines, the beeswax of Kenya occupies a favored position for establishing differentiation among competitors.

Among the beeswax imported to Japan from Africa, that from Tanzania accounts for the largest proportion (around 30%) of which actual cargos consist of blocks cast in molds of a shape of trapezoid weighing about 50 kg. Regarding the state of beeswax, while there is little variation in respect of color, actual imported cargos contain carcasses of honey bees, wood chips and sand, which suggests that the products to be imported from Kenya would possess the same level of quality. Unlike foods, the products in such conditions reportedly create absolutely no problem in the process of custom clearance.

3) Procedures for importing honey to Japan

From the viewpoint of ensuring safety, all the food products to be imported into Japan are subject to the clauses of Article 27 of the Food Sanitation Law which stipulate that importers are obligated to make notification about the act of importation, stating "Those who wish to import food, food additives, apparatuses, or container/packages for sale or for use in business, shall notify the Minister of Health, Labour, and Welfare on each occasion as prescribed by the Ministerial Ordinance", and the imported foods and related products must not be used for sale without import notification.

"Notification Form for Importation of Foods, etc." is submitted to a Quarantine Station of the Ministry of Health, Labour and Welfare. At the quarantine station, food sanitation inspectors carry out document examination and inspection to see to

it that the foods and products comply with the Food Sanitation Law. .

【Requirements concerning tariff classification】

Natural honey is defined as that in which the sucrose content accounts for less than 5 % of the total weight and the fructose content accounts for more than 30 % of the total weight, and at the same time, the proportion of fructose among total sugar components exceeds 50 %. Regarding the verification of contents of ingredients in official procedures of the importing country, the analysis data prepared by the exporter or the manufacturer of an exporting country and authorized by an official organization including the local chamber of commerce shall be approved, and therefore, for importing a particular article, it is needed to acquire an official document like “Certificate of quality”.

【Requirements concerning Food Sanitation Law】

(i) Requirements concerning formalities of notification of importation

In order to import articles of food and products associated with food which are used for commercial purposes, it is required to submit “the form of notification of importation of articles of food and related products” together with relevant documents to the service responsible for surveillance of imported articles of food at a quarantine station of the Ministry of Health, Labour and Welfare. After undergoing the procedures of examination and testing at the quarantine station, if no problem has been identified on the ground of application of Food Sanitation Law, the form of notification shall be returned to the notifier with an official seal “Notification Certified” stamped on it.

(ii) Requirements concerning the labelingof contents

In order to sell products contained in containers and packages, the labeling complying with Food Sanitation Law is obligatory.

(iii) Regarding the regulation on the residues of agricultural chemicals and the like,

the requirements are defined in compliance with the positive list system (Clause 3, Article 11 of Food Sanitation Law).

【Requirements concerning the Law of Standardization and Proper Labeling of Agriculture and Forestry Products (JAS Code)】

In compliance with the law, it is obligatory at the points of sale to indicate comprehensively the data on products, according to the criteria for labeling of quality. For imported goods, the representation of the county of origin is compulsory.

【Requirements concerning the Act against Unjustifiable Premiums and Misleading Representations (Premiums and Representation Act)】

Regarding natural honey products, a private organization, National Conference on Fair Trading of Honey, Inc., has set out as a guideline for voluntary control by the sector, "Agreement on fair competition concerning the representations of honey bee products".

【Requirements concerning preferential tariff treatment】

As Kenya is designated as a beneficiary country of preferential tariff treatment, the importation from the country can benefit from its application. In order to benefit from the application of a preferential tariff rate, it is necessary to acquire "the certificate of origin eligible for preferential tariff treatment" issued at the time of exportation by the local country from which the goods are exported (the certificate is not required if the total monetary value involved is less than 200,000 yen.)

* The system of preferential tariff treatment is the one which is intended to promote the industrialization and the economic development of developing countries by expanding the exporting capacity of such countries through the

application of tariffs lower than general rates (preferential tariffs) on products from them. In Japan the system is stipulated in the Clause 2, Article 8 of Temporary Tariff Measures Law and a list of articles for application of this law is prescribed as an annexed table. Moreover, the countries and regions that are eligible to benefit from the system of preferential tariff treatment are collectively termed as "beneficiary countries of preferential tariff".

【Requirements concerning import customs clearance】

Importers submit to the customs house the "Declaration of import (duties)", together with relevant documents including "the certificate of import notification of foods and related products" acquired through the procedures described above, invoice, B/L, detailed statement of insurance, etc. After examination, inspection and payment of taxes, the import permit is issued.

* Invoice: it is notification of shipment of goods, or a statement of delivery, but signifies a bill.

* B/L : Bill of Lading

4) Procedures of importing wax

【Requirements concerning tariff classification】

Waxes and derivatives are classified under the clause 8, but beeswax is classified under the clause 1521 together with vegetable wax, insect wax, and whale wax, and candles and the like are classified under the clause 3406. The actual classification varies depending on the state and constituents, and consequently it is necessary to confirm particulars through inquiries made to the customs house.

【Requirements concerning Pharmaceutical Affairs Law】

When one intends to import and sell as business, among different products of beeswax, those used as coating agents for medicines, raw materials for making

base agent, or other medical drugs, it is necessary to obtain the permit for running the business of fabrication and distribution in compliance with Pharmaceutical Affairs Law, and authorization for the operation on the basis of item by item.

Moreover, when beeswax products are to be imported as articles for running business, it is necessary to submit by the time of customs clearance to the regional administrative office of Kanto-Shin-Etsu or to that of Kinki of the Ministry of Health, Labour and Welfare a written notice of importation for its confirmation, reporting the designated items of information, including the name and address of manufacturer/trader, the type of permit for running business of manufacturing/trading, permit number, date of authorization, the designations of products to be imported, etc.

However, regarding the importation of products as a commodity sample, for private use by physician, for experiment or therapeutic testing, if the quantity does not exceed a designated limit, commodities can be imported only by presenting required documents. For the quantity exceeding the designated limit, they can be imported by presenting required documents to the expert official of pharmaceutical surveillance at the above mentioned regional office of the Ministry and by receiving the certificate of pharmaceutical surveillance.

The inquiries for detailed information are processed by sections in charge of pharmaceutical affairs of provincial (prefecture) governments.

【Requirements concerning Food Sanitation Law】

For the importation of beeswax products used as food additives such as the base of chewing-gum and brightener, it is necessary to submit to the quarantine station of the Ministry of Health, Labour and Welfare the document, “Import notification of foods and related products”. Food additives are exempted from the application of the Positive List system.

【Requirements concerning preferential tariff treatment】

Similarly as the case of honey, beeswax importation from beneficiary countries of preferential tariff can benefit from the taxation system of preferential tariff treatment.

【Requirements concerning import customs clearance】

The same procedures can be applied.

5) Procedures of notification of importation

(i) Preparation of the notification form for reporting the importation of commodities

(ii) The notification form comprises blanks for prescribed items that have to be filled completely.

(iii) When the notification form of importation and required documents get ready, they are submitted to the quarantine station of the Ministry of Health, Labour and Welfare exercising jurisdiction over the port for landing goods. Currently, regarding the procedures of notification of the importation of articles of food and related products to the Ministry of Health, Labour and Welfare, it is possible to present the documents not only by written papers but also by means of data transfer through electronic telecommunication.

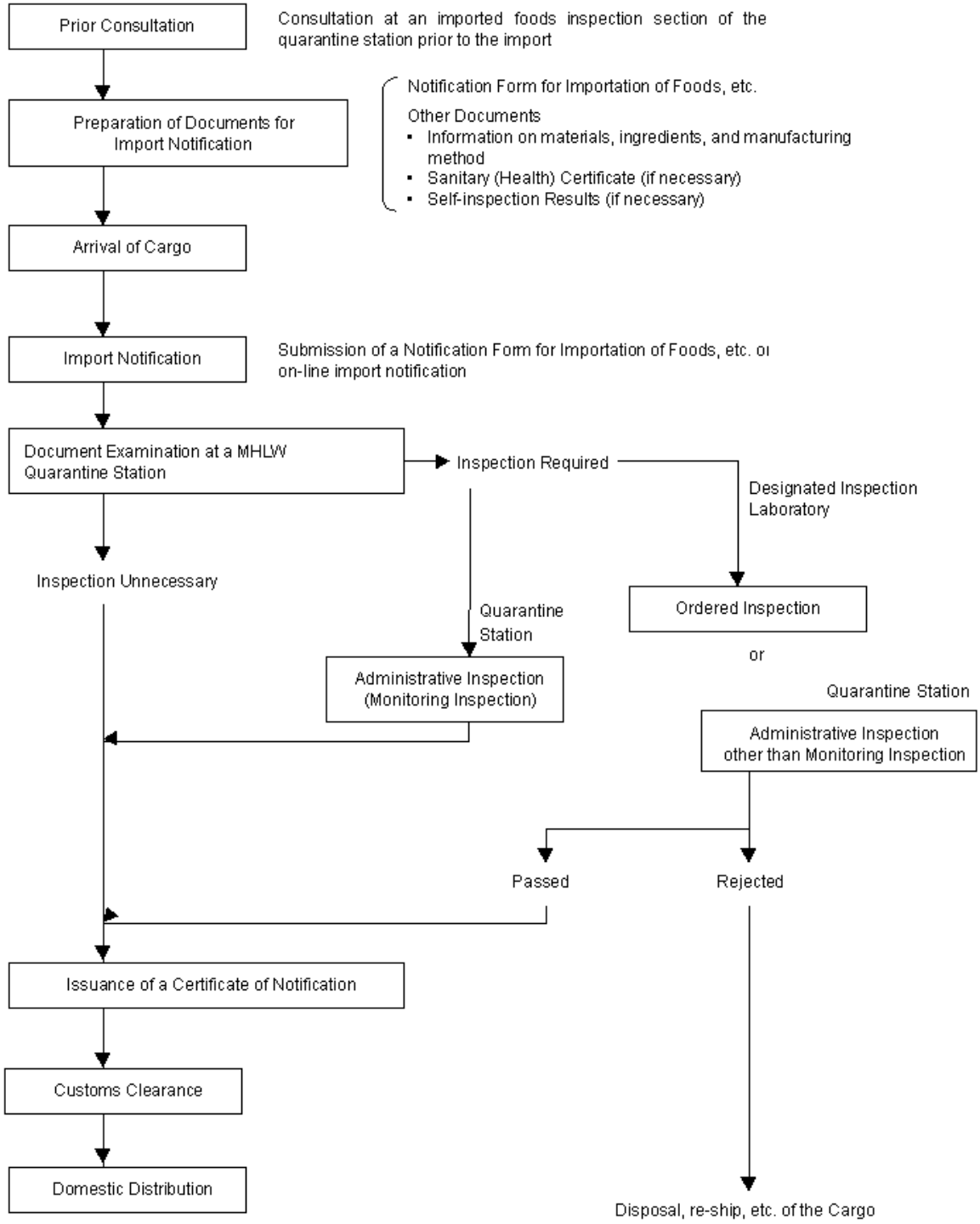


Diagram　Flow of steps for import notification of foods and food related products

(Source) Webpage of Service of surveillance of imported foods, Ministry of Health, Labour and Welfare

http://www.mhlw.go.jp/english/topics/importedfoods/1-1.html

6) Trading by letter of credit

When the business of import and export is carried out through transactions by letter of credit (L/C), a document, certificate of origin, is required. Certificate of origin is a document which testifies that the commodity to be traded has been produced, manufactured, or processed in a particular country or a particular region. Regarding the procedure for delivering the certificate of origin, it is issued by an organization designated by each of those countries which have ratified the "International Convention relating to the simplification of Customs Formalities signed on November 3, 1923 in Geneva (Geneva Treaty)", in compliance with the Article 11 of the Treaty. Since the certificate of origin is prepared, in principle, in English, the contents are described as follows:

【Contents of a certificate of origin】

Exporter: Name and address (including country) of the enterprise (individual) actually carrying out the exportation

Consignee: Name and address (including country) of the enterprise (individual) receiving the cargo

Print ORIGINAL or COPY: The indication whether the document is an original "ORIGINAL" or a copy "COPY" has to be made without fail :

When the issuance of multiple copies is requested, up to 3 copies qualified as "ORIGINAL" can be delivered. When the number of copies requested exceeds 3, the fourth copy and succeeding ones are indicated as "COPY".

No. and date of Invoice: Number and date of invoice of the product the origin of which is certified.

Country of Origin:

Transport Details: While, in the case of invoice, it is necessary to describe in detail

the modes of transportation, on the certificate of origin, it is permissible to omit the description of shipping point, discharge point and points on the route, and to mention simply “By Vessel” or “By Air”.

Remarks: Mention is dispensable. Space is used to describe, if necessary, trading requirements, condition of payment, code number of L/C, contract number, etc.

Marks, numbers, number and kind of packages; Description of goods:

A. Marking of cargo, cargo number: markings and numerical data indicated on the imported cargo are mentioned.

B. Numbers and types of packing: modes of packing, such as “carton”, “box”, “crate”, and number of each type of packing are mentioned. When cargos are not packed, statements such as “unpacked” or “Loose” should be made. When the commodity is transported in containers, the container numbers and seal numbers should be stated, as “Container No. xxx”, “Seal No. yyy”.

C. Designation of commodity : general designation of commodity should be mentioned. As the certificate cannot be issued for the commodity in brand name or commodity code, it is necessary to mention the general designation of the commodity. Incidentally, in general, as designations, those corresponding to HS codes of 6 digits* are used.

Quantity: the same quantity expressed in the invoice is mentioned for each commodity, in the same specific unit like “pcs”, “sets”, or “kg”, etc.

Declaration by the Exporter: date of application for issuance and the name of exporter are mentioned and signature is added. Only the registered signature is valid and allowed.

Certification (certification by chamber of commerce): space for certification by the chamber of commerce. The applicant cannot write anything in this space.

Certification No.: number written by the chamber of commerce

*HS code : HS stands for Harmonized Commodity Description and Coding System. By HS code nomenclature system, all traded commodities are classified by codes of 6 digits, and every 2 digits of them are allocated to either one of the 3 levels of “section” and “chapter”,” genus”, and “clause”. In the HS treaty, participant countries are allowed to add 4 more digits from 7th to 10th digits for their own classification purposes according to their particular needs, and hence in Japan the system of 10 digits is used. In order to know correctly the correspondence between a HS code and a particular commodity designation, it is often needed to have specialized knowledge. Consequently, if an importer unscrupulously uses the HS code transmitted by the exporter to prepare the documents for domestic import formalities, and if the code turns out to be irrelevant in the judgment of the customs house, a certain situation may arise in which the importer has to revise the formality documents or has to take a procedure to amend the tariff rate. In the importation of a new commodity for the first time, it is recommended to make use of “the system of preliminary instruction on tariff classification” provided by the customs house, to ascertain in advance the tariff classification and the tariff rate.

Incidentally, in the case of Kenya, since it is possible to benefit from the preferential tariff treatment, it is needed to acquire “the certificate of origin eligible for general preferential tariff treatment (Form A)”.

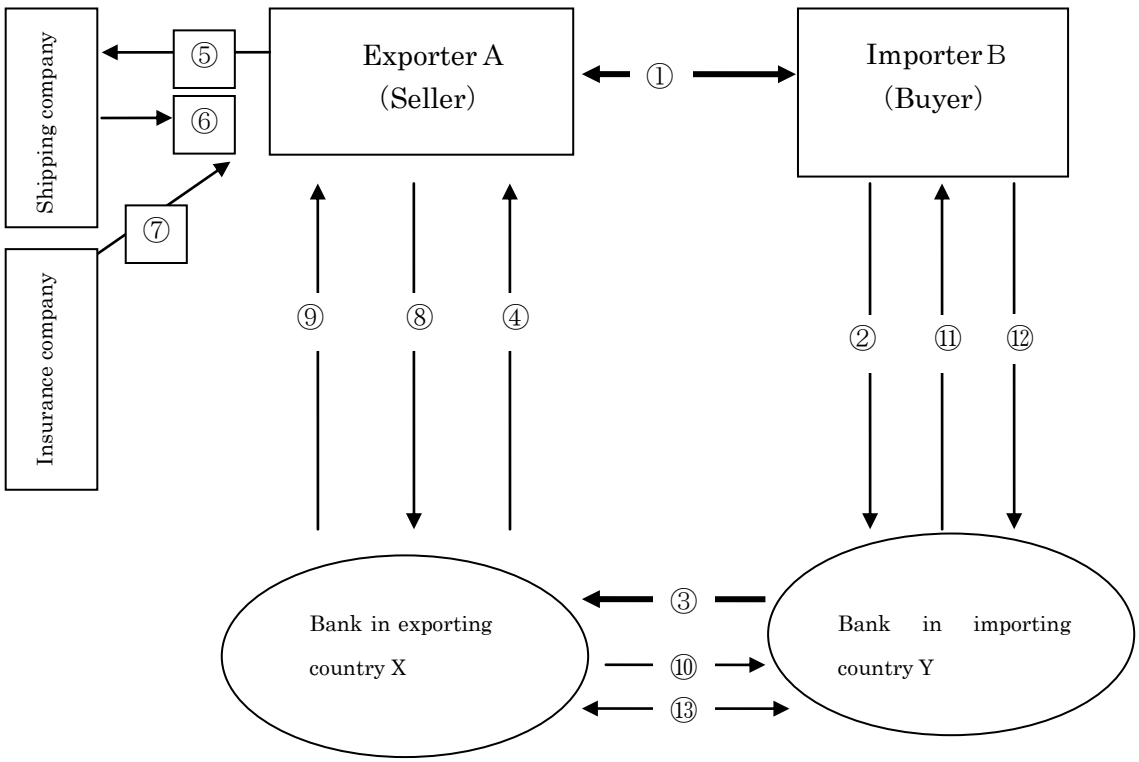


Diagram: Flow of the settlement of accounts of transactions by letter of credit

i. Contract for sale is concluded between seller A and buyer B.

ii. Buyer B requests the bank Y in importing country to issue a letter of credit. At this time, B is called the applicant for L/C.

iii. The bank in importing country Y issues an L/C. Y is called the L/C Issuing Bank.

iv. The L/C is advised to the seller A through the bank X in exporting country. X is called the L/C advising bank.

v. The seller arranges the cargo according to the conditions specified in the L/C, makes out shipping documents, and delivers the cargo and the documents to the shipping company, requesting the shipment to importing country.

vi. The shipping company that has shipped out the cargo issues a bill of lading (B/L) as an evidence of the shipment and delivers it to the seller A.

vii. According to the request from the seller A, the insurance company issues a

policy of insurance.

viii. In order to collect the bill, the seller A puts together the required documents procured from the shipping company and the insurance company (bill of lading and policy of insurance), issues a bill of exchange and asks the bank X in exporting country to purchase it.

ix. The seller A receives the proceeds of the sale from the bank X in exporting country.

x. The bank X in exporting country sends the bill of exchange and the documents purchased from the seller to the L/C issuing bank, and at the same time requests the latter to refund the cost of the bill that it paid to the seller.

xi. The bank Y in importing country (L/C issuing bank), in order to get paid for the cost, sends the arrival notice of the documents to the buyer B, asking it to settle the bill.

xii. The buyer B settles the bill of importation and receives the bill of lading. It collects the cargo from the shipping company in exchange for the B/L.

xiii. The settlement of accounts is accomplished between the bank X in exporting country and the bank Y in importing country.

In the settlement of accounts of trading transactions, that by L/Cs is generally executed. The exact term of the device is “documentary letter of credit”, and in order to have an L/C issued, the importing trader has to undergo a credit screening imposed by the issuing bank. After passing the screening, the trader submits a deed of contract for L/C transactions. Consequently, it is needed to have a prior consultation with the bank concerned.

The above section has described essential and fundamental points when the trading of export and import of honey bee related products from Kenya is considered. In actual transactions, it is the most convenient way to make inquiries through the website of the Ministry of Health, Labor and Welfare for dealing with the formalities of notification. Moreover, concerning the mode of settlement of accounts,

it is carried out in diverse manners depending on specific situations, and hence only the basic mechanism of L/C trading has been described. It is recommended to seek advices from Japan External Trade Organization, JETRO, in various situations.

Japan External Trade Organization
http://www.jetro.go.jp/

Ministry of Health, Labour and Welfare: Imported Foods Inspection Services
http://www.mhlw.go.jp/english/topics/importedfoods/index.html

At any rate, the most important matter in the trading of honey bee related products is certainly the relationship of unfaltering mutual trust with local partners.

[APPENDIX]

Websites for technical information on apiculture development and beekeeping

Bees for Development

http://www.beesfordevelopment.org/

including

What We Do／Information Centre>Beeswax／Journal／Online Book Store

International Bee Research Association

http://www.ibra.org.uk/

including

Journals／Shop／Information Services

Apiservices

http://www.apiservices.com/_menus_fr/index.htm?menu.htm&0

including

Apishop ／Country info ／Articles / Reports ／Databases

Mid-Atlantic Apiculture Research and Extension Consortium (USA)

http://maarec.cas.psu.edu/

Bee Culture

http://www.beeculture.com/index.cfm

including

McGregor's Handbook of Pollination *Bee Culture's* Online Book Store

The Science of Beekeeping Apis Information Resource Center

Cornell Pollination Study, by Roger Morse and Nick Calderone

Canadian Honey Council

http://www.honeycouncil.ca/index.php

including

Beekeeping Industry Facts and Information/Diseases and Pests

/Beekeeping in the Developing World

Australia

http://www.honeybee.org.au/pdf/wonderfull01.pdf

http://www.agric.wa.gov.au/index.htm

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