Beekeeping and sustainable livelihoods

Diversification booklet 1

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Preface

Diversification booklets

FAO Diversification booklets aim to raise awareness and provide information about opportunities at the farm and local community level to increase small-scale farmer income. Each booklet will focus on a specific farm or non-farm enterprise or technology that experience has shown can be integrated successfully into small farms or at a local community level. We explore the potential benefits associated with new activities and technologies, as well as appropriateness and viability in differing circumstances.

The main target audience for FAO Diversification booklets are people and organizations that provide advisory, business and technical support services to resource-poor small-scale farmers and local communities in low- and middle-income countries. We hope to provide enough information to help these support service providers consider new income-generating opportunities, and how they might enable small-scale farmers to take action. What are farmer requirements and constraints? What are critical "success factors"?

FAO Diversification booklets are also targeted to policy level people in government and non-governmental organizations. What actions might policy-makers take to create enabling environments for small-scale farmers to diversify into new income-generating activities?

It is important to point out that the Diversification booklets are not intended to be technical "how to do it" guidelines. In order to provide farmer advisory and support activities relating to introduction of new income-generating activities, most organizations will find it necessary to seek more information or technical support. For these organizations, each booklet identifies complementary sources of information and technical support.

If you find this booklet of value we would like to hear from you. Tell your

colleagues and friends about it. If you have any suggestions where we can make changes for the better in our next edition, or topics for other booklets – this is equally important. By sharing your views and ideas with us we can eventually provide better services to you.

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Beekeeping helps to create sustainable livelihoods

Beekeeping does not attract much attention. It is easy to visit villages and not "see" beekeeping, unless actively looking for it. Beekeeping, however, is crucially important for agricultural well-being; it represents and symbolizes the natural biological interdependence that comes from insects, pollination and production of seed. Useful small-scale efforts to encourage beekeeping interventions can be found throughout the world, helping people to strengthen livelihoods and ensuring maintenance of habitat and biodiversity.

Strengthening livelihoods means helping people to become less vulnerable to poverty. This is achieved by helping them to gain greater access to a range of assets, and supporting their capacity to build these assets into successful livelihood activities. This booklet shows the useful role that beekeeping can play in creating sustainable livelihoods.

People who have limited cash or financial savings often have other assets or strengths – as opposed to needs – that can be mobilized. Chambers and Conway (1992) developed what is now the accepted definition of a livelihood:

> "A livelihood comprises the capabilities, assets and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base."

Beekeeping assets

Individual livelihoods depend on access to many types of assets which fall into five categories: natural, human, physical, social and financial. To understand this, think about your own livelihood and all the diverse assets you depend upon: your skills, access to transport, equipment, telecommunications and the social networks you have been born into or have created yourself. No individual category of capital assets, such as finance, is sufficient on its own to create a livelihood.

Beekeeping is a useful means of strengthening livelihoods because it uses and creates a range of assets. Successful beekeeping draws upon

Types of capital assets needed for beekeeping

Natural: bees, a place to keep them, water, sunshine, biodiversity and environmental resources;
Human: skills, knowledge, good health and strength, and marketing expertise;
Physical: tools, equipment, transport, roads, clean water, energy and buildings;
Social: help from families, friends and networks, membership of groups and access to a wider society, market information and research findings;
Financial: cash, savings and access to credit or grants.

all categories of capital assets, although financial capital is **not** essential for getting started in productive beekeeping.

Natural capital assets

Beekeeping livelihoods are built upon natural resource stocks: bees, flowering plants and water. Bees collect gums and resins from plants and use plants and trees as habitat for nesting. Bees are a natural resource, and freely available in the wild. Where bees have not been poisoned, damaged or harmed, they will collect wherever they are able, provided the natural conditions include available flowering plants. Wild or cultivated areas, wasteland and even areas where there may be land mines all have value for beekeeping. Beekeeping is possible in arid areas and places where crops or other enterprises have failed; the roots of nectar-bearing trees may still be able to reach the water table far below the surface. This makes beekeeping feasible in marginal conditions, which is important for people who need to restore their livelihoods or create new ones.

Beekeeping fits in well alongside many other livelihood endeavours because it uses the same natural resources as, for example, forestry, agriculture and conservation activities. Beekeeping provides an excellent bonus in addition to other crops rather than instead of them, because only bees are capable of harvesting nectar and pollen. There is no competition with other insects or animals for these resources that otherwise would be inaccessible to people. Beekeeping ensures the continuation of natural assets through pollination of wild and cultivated plants. Flowering plants and bees are interdependent: one cannot exist without the other. As bees visit flowers, they collect food and their pollination activities ensure future generations of food plants, available for future generations of bees and

FIGURE 1 A mother and child in Nepal: just one hive of bees makes a significant contribution to the resources of the household.

for people too. It is a perfect self-sustaining activity. Pollination is difficult to quantify, but if it could be measured it would be the most economically significant value of beekeeping.

By definition, a livelihood should enhance capabilities "while not undermining the natural resource base" (Chambers and Conway, 1992). Beekeeping goes beyond this, because it actually helps to sustain the natural resource base. Throughout the world, beekeeping has traditionally been part of village agriculture. Now, as farming practices change, it is essential to ensure that beekeeping is retained and encouraged in order to provide continued populations of pollinating insects.

Human assets

Many societies have considerable traditional knowledge and skills concerning bees, honey and related products. The products of beekeeping are often used by women: the important *tej* (honey wine) industry in Ethiopia, for example, is run by

FIGURE 2 Many African women add to their livelihoods by brewing and selling honey beer. Ethiopian women make and sell tej (honey wine) and non-alcoholic drinks based on honey.

women. Elsewhere in Africa, women brew and sell honey beer. These are the types of human assets or skills needed to create livelihoods within a society. Beekeeping projects have sometimes ignored existing knowledge or implied that it was wrong or out of date, which is worse. The best beekeeping projects recognize existing skills and build on them for greater income generation and to ensure sustainability.

Physical assets

Successful beekeeping enterprises require production equipment and infrastructure such as transport, water, energy, roads, communication systems and buildings. There are many ways to manage bees and obtain crops of honey, beeswax or other products. In sustainable beekeeping projects, all equipment must be made and mended locally which, in turn, contributes to the livelihoods of other local people. Beekeeping can add to the livelihoods of many different sectors within a society including village and urban traders, carpenters who make hives and stands, tailors who make veils, clothing and gloves and those who make and sell tools and containers.

Social assets

Social resources such as networks and producer and marketing associations have great significance for beekeeping development. Local associations provide the means for beekeepers to advance their craft, lobby for the protection of bees, organize collective processing for honey and wax, and gain access to markets. Access to networks at a wider level through non-governmental organizations (NGOs) such as Apimondia and Bees *for* Development helps beekeepers to make national and international contacts, find sources of training, markets and new research results, and improve their understanding of the industry.

Financial assets

Although significant financial assets are not essential to initiate beekeeping activities at subsistence level, they are essential for development of beekeeping enterprises. Successful marketing depends on adequate supplies of containers for processing and packaging. Credit is necessary for beekeeping associations to run collection centres and for traders to buy honey and beeswax.

A good beekeeping project will utilize available assets; it will not depend on imported resources or equipment, such as the beeswax foundation used in frame hives (see Figure 26). There are situations all over the world where beekeeping can be especially valuable because it remains an activi-

ty that is possible for people living in the most difficult circumstances, perhaps isolated by war or sanctions. This is because bees are almost always available in the wild and equipment can be made from whatever materials are at hand.

Beekeeping outcomes

Beekeeping produces a number of quite different outcomes.

- Pollination of flowering plants, both wild and cultivated, is vital for continued life on earth. However, this essential process is difficult to quantify.
- People everywhere like honey, the best-known beekeeping product. Honey is a traditional medicine or food in most societies. Whether sold fresh at village level or in sophisticated packaging, honey generates income and can create livelihoods for several sectors within a society.
- Beeswax is a valuable product of beekeeping, and much of the world's supply comes from developing countries.
- Beekeeping products such as pollen, propolis and royal jelly can be harvested and marketed, although special techniques and equipment are needed for some of these products.
- Beekeepers and other community members can create assets by using honey, beeswax and other products to make secondary products such as candles, skin ointments and beer. Secondary product brings a far better return for the producer than selling the raw commodity. This work strengthens people's livelihoods.
- Products of beekeeping are used for apitherapy in many societies.
- Honey, beeswax and products made from them, such as candles, wine and food items, have cultural value in many societies and may be used in rituals for births, marriages, funerals and religious

FIGURE 3 A beekeeper in the Amazon. Honey is a useful source of income for people living in or near tropical forests.

celebrations.

- Beekeepers are generally respected for their craft. Bees and beekeeping have a wholesome reputation. Images of bees are used as symbols of hard work and industry, often by banks and financial institutions.

These outcomes are real and they strengthen people's livelihoods, even though some of them cannot be fully quantified. Beekeeping helps people to become less vulnerable, strengthens their ability to plan for the future and reduces the danger that they will slip into poverty in a time of crisis, for example, if a family member becomes ill or crops fail.

Bees are diligent pollinators of fruit and seed crops

What is pollination?

Pollination is necessary for all seed and fruit production by flowering plants. Transfer of pollen among flowers to allow their reproduction is a vital mechanism for maintaining life on earth. People harvest the seeds of some crops for food; examples are oilseed crops, nuts, legumes such as beans and peas, and cereals such as rice and maize. Other crops provide fruit that develops with the seed, for example citrus fruits, mangoes and tomatoes. Seed is required for the production of the next generation of crops and allows plant-breeding programmes to improve varieties.

Bees are good pollinators

Plant reproduction requires the transfer of pollen from the anthers, or male part of a flower, to the stigmas, or female part of a flower, either on the same plant or on a separate plant that may be some distance away. After thousands of years of evolution and adaptation to local environments, each plant species has specific requirements for this important transfer of pollen; many depend on foraging insects to transfer pollen among flowers. Many species of insects visit flowers to seek nectar or pollen; while doing so most will transfer a few pollen grains, thus contributing to pollination. Honeybees are highly efficient pollinating insects, because:

- they have hairy bodies that easily pick up thousands of grains of pollen as they move about inside

FIGURE 4 Everywhere in the world where there are flowering plants – there are bees , and over 25 000 species have so far been described.

flowers;

- they visit only one species during each foraging trip;
- each foraging bee not only collects sufficient food for its own requirements, but continuously forages for nectar and pollen to supply the daily food needs of the colony.

During a single day, one bee may visit several thousand flowers of one plant species, collecting nectar and pollen and continuously transferring pollen grains from one flower to another.

Cross-pollination

Cross-pollination occurs when an insect moves pollen from one plant to another. It is needed when plant sexes are segregated on different plants, such as melons, or by different periods of flowering of the same plant, such as avocado. Many varieties of fruit trees need cross-pollination; they should be planted so that pollinizer trees are near the main crop trees. Production of hybrid seed crops on a commercial scale creates a special need for cross-pollination by insects: a large population of pollinating insects is needed to carry pollen from rows of male plants to rows of female plants.

Pollination affects crop quality and quantity

Crops vary in the extent to which they benefit from insect cross-pollination. Some crops, such as field beans and mangoes, are self-pollinating but give better yields if pollinated by insects. Many, such as passion fruit, cowpea, sesame, litchi, mustard and cashew, give a substantially increased yield when pollinated by insects. Others such as sunflowers, clover, beans, almonds and melons are completely dependent on pollination by insects and otherwise will not produce crops.

Adequate insect pollination affects both the quantity and quality of crops: uneven, small fruit often indicate insufficient pollination. Adequate pollination

FIGURE 5 Coffee in Yemen. Yield improves significantly when optimally pollinated by bees; beekeepers obtain good honey crops from the abundant nectar produced by coffee flowers.

by insects also ensures that early flowers set seed. This results in a uniform and early harvest and gives the crop the maximum length of time to ripen.

Pollination can be as important in crop production as water or fertilizer. With the use of improved cultivars and irrigation, pollination can be the limiting factor. The pollination requirements of all major temperate zone crops are well known. In countries with highly mechanized agriculture, the use of bees for pollination increased greatly during the twentieth century and became an integral part of crop production. Less research has been done on the pollination requirements of crops grown in the tropics.

Protecting pollinators

Many other species of bees and pollinating insects living in the wild are highly important for pollination, in addition to honeybees living in the wild or managed in hives by beekeepers. Many factors have caused a decline in the numbers of these insects available for crop pollination. The most serious threat to pollinating insects is the use of insecticides. Herbicides, grazing or cutting of roadside verges and other destruction of flowering plants remove food sources for pollinating insects. Intensive land cultivation and destruction of hedges, banks and rough verges further reduces the habitat for nesting and hibernation sites for bees.

It is in everyone's interest to maintain strong populations of honeybees and other pollinating insects. This means increasing people's awareness of the value of insect pollination, stopping unnecessary pesticide use and increasing forage for bees by including nectar-bearing bushes and trees in planting schemes. Farmers can contribute to the protection of honeybees and their habitats as follows.

- Select and use insecticides with great care; if wild pollinating insects are destroyed, there is a risk of decreased crop yields in the future.
- Never use insecticides when flowers are open; foraging insects work on open blossoms and are killed by sprays at this time; if insecticides must be used, spray at a time of day when crop flowers are closed.
- Allow wild plants to flower on wasteland, because they will help to support populations of foraging insects.
- Make habitats more acceptable for nesting and hibernation of pollinating insects.

More pollinating insects needed

Paradoxically, intensive agricultural practices diminish the numbers of wild pollinators and at the same time increase

the need for them. Larger fields increase the need for pollination while a crop is flowering, yet decrease the ability of the local insect population to pollinate adequately. The tendency to concentrate particular crops in certain areas intensifies this situation, because when the major crop is not in flower there may be insufficient forage from other sources.

In temperate countries, large-scale monocultures have increased the need for pollination, yet have decreased the populations of wild pollinators. A similar dilemma is arising in the tropics, where there has been an increase in mechanized farming and an accompanying increase in field size. In the tropics, however, crop flowering is more prolonged and less intensive than in temperate regions. Where growing conditions are favourable, the same crop species may occur in a sequence of growth stages. Many fruit trees flower and fruit throughout the year, albeit more abundantly at certain periods, and therefore forage for bees may be present at all times.

Increased monoculture in the tropics means that flowering will be more concentrated, so large pollinator populations will be needed for shorter periods. Although pollen sources that allow cross-pollination are naturally present in small mixed farms, special provisions for crop pollination are necessary for large areas of a uniform crop (Free, 1999).

FIGURE 6 Market stall in Egypt. Adequate pollination increases the quality and quantity of many cash crops.

Bees around the world

Many species of bees collect nectar, they convert to honey and store as a food source. Only bees that live together in large colonies store appreciable quantities of honey; these include bees of the genera *Apis* (honeybees), *Trigona* and *Melipona* (stingless bees) that people have recognized throughout the ages as sources of honey. Until the seventeenth century, honey from bees was the only commonly available sweetening substance.

The most widely used honeybees are European races of *Apis mellifera*, a species of honeybee also indigenous to Africa and the Middle East. Honeybees are not indigenous to the Americas, Australia, New Zealand or the Pacific islands, but during the last four centuries European races of bees have been introduced to these regions. During the last 30 years, European bees have been used increasingly in Asia. Beekeeping equipment and technology have been developed for use with European races of honeybees. Most beekeeping literature relates only to these bees.

Africa

Apis mellifera are indigenous to tropical Africa. They are slightly smaller than the European races of *Apis mellifera* and their behaviour is notably different. They are more readily alerted to leave the comb and defend themselves. Tropical honeybees are more likely to abandon their nest or hive if disturbed, because they have a greater chance of survival in the tropics. In some areas, honeybee colonies migrate seasonally.

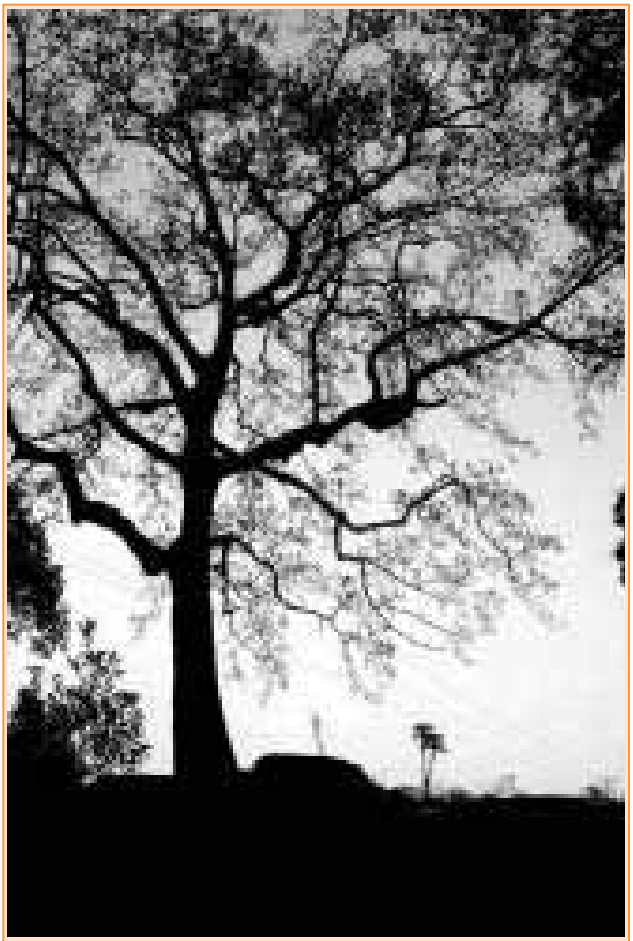

FIGURE 7 Colonies of wild nesting bees are the major source of honey in many areas of India. These colonies will be harvested by honey hunters who climb the trees, cut off the honeycombs and lower them to the ground in baskets.

These are crucial factors governing tropical bee management.

Asia

There are many indigenous honeybee species in Asia. Some can be managed in hives; others build individual combs in the open and cannot be kept in hives. Honey hunters plunder these combs for honey. In Bangladesh, India and Nepal, for example, most honey comes from gathering the large combs of wild nesting bees.

The Americas

There are no indigenous honeybees in the Americas. Their ecological niche is filled by many different species of stingless bees that were and in some areas still are exploited for their honey, which is particularly valued for its medicinal properties. Knowing nothing of these indigenous bees, European settlers long ago brought with them European bees, on which basis the industry developed. In 1956, some African *Apis mellifera* queens were introduced into Brazil. These bees survived far more successfully in tropical Brazil than their European *Apis mellifera* predecessors, and quickly proved dominant over them; they are known as "killer bees" in the media and have spread through much of South and Central America and southern parts of the United States. They have many of the typical African honeybee characteristics that have necessitated changed management practices and led to increased yields for beekeepers.

FIGURE 8 Hive for stingless bees in Brazil.

Honey – popular food

Mention bees, and most people think of honey. Almost every society on earth has traditionally known and used honey. Cave paintings near Valencia in Spain from 15 000 years ago depict men gathering honey. The Bible and the Koran extol the virtue of honey as a valuable and nourishing food. The reputation of honey as a wholesome and popular commodity is a useful basis upon which to create livelihoods.

What is honey?

Flowers need bees to visit them so that plants will be pollinated. As an incentive, they supply nectar. Nectar is a solution of sugars and other minor constituents that bees collect and concentrate into honey. Honeys contain a wide range of sugars, varying according to the nectar source, and small amounts of other substances such as minerals, vitamins, proteins and amino acids. The temperature in a nest near the honey storage area is usually about 35 °C. This temperature and the ventilation produced by fanning bees cause water to evaporate from the honey. When the water content is reduced to about 20 percent, the bees seal the cell with a wax capping. The honey is now considered "ripe" and will not ferment. In this way the bees prepare for themselves a concentrated food source packed in minimal space. It is free from problems of fermentation; therefore bacteria cannot grow in the honey and it will not deteriorate during storage. This food sustains the bees through periods when there are no flowers.

Pollen is a minor but important component of honey. It is carried to the nest and stored quite separately from nectar, but a few pollen grains inevitably find their way into nectar and eventually into the honey. If the pollen in honey is identified through a microscope, it gives a guide to the plants on which the bees have been foraging.

Honey quality

The aroma, taste and colour of honey are determined by the plants from which the bees have gathered nectar. Sunflowers, for example, give a golden yellow honey; clover gives a sweet, white honey; agave species give honey a bitter taste that is popular in some societies. Dark honey usually has a strong flavour and often has a high mineral content; pale honey

has a more delicate flavour. The popularity of dark and light honey varies from country to country. Colour can also indicate quality, because honey becomes darker during storage or if it is heated. However, some perfectly fresh and unheated kinds of honey can be dark in colour.

Glucose is a major constituent of honey. When the glucose crystallizes, the honey becomes solid and is known as granulated honey. Depending on the plants the bees are visiting, some kinds of honey are more prone to granulation than others; almost all honey granulates if its temperature falls below 15–24 °C. As with colour, different people favour different qualities of honey. Some prefer granulated honey, while others choose liquid honey. Granulation is a natural process; there is no difference in nutritional value between solid and liquid honey. Some kinds of honey look cloudy because they contain a high level of pollen. Such honey is sometimes said to be of low quality, although the presence of pollen makes the honey even more nutritious. In Europe and North America, a new market is developing for honey that has been cold-filtered and not processed to remove all pollen.

Harvesting honey

Honey inside the nest that the bees have sealed with a wax capping is regarded by beekeepers as ready for harvest. Honey at this stage is pure and perfect, whether it is in a wild nest, a home-made hive or the most expensive factory-made hive. The subsequent harvesting and processing of honey determine whether this quality is retained or whether it will be spoiled by contamination, overheating or over-filtration. This means that rural beekeepers using simple equipment can produce honey of top quality. If the beekeepers are working in remote places far from roads and industry, the honey may even be

FIGURE 9 Piece of honeycomb in India. When honey is presented this way, the consumer can see that it is fresh and uncontaminated.

certified as organic and command a premium price. Honey processing on a small-scale requires the same simple equipment that is used in other forms of food preparation: bowls, sieves or straining cloths and containers.

Water content

If the water content of honey is greater than 23 percent, the honey is likely to ferment. Low water content is therefore important. Water content can be measured using a honey refractometer, which is a small instrument that measures the refraction of light as it passes through a glass prism on which a few drops of honey have been smeared. In climates with high humidity where it can be difficult to retain low water content in honey, airtight plastic buckets with lids are essential for honey storage.

Values of honey

Honey has value as a food, as a medicine, as a cash crop for both domestic and export markets and as an important part of some cultural traditions.

As a food

Honey is valued everywhere as a sweet and tasty food. At times of food shortage it is a useful carbohydrate source that contains trace elements and adds nutritional diversity to poor diets. Honey often has an important place in traditional food preparation.

As a medicine or tonic

In many parts of the world, honey is used as a medicine or tonic and as a special treat for children. Modern medicine is increasingly using honey for a variety of treatments.

As a cash crop

Fresh local honey is always more highly valued than imported honey. Many beekeepers sell their product directly to consumers. Honey is often used as a barter commodity in villages, especially in remote areas or areas isolated by war or sanctions. Honey is a stable commodity with a long shelf life. If harvested carefully, it will remain wholesome for many years.

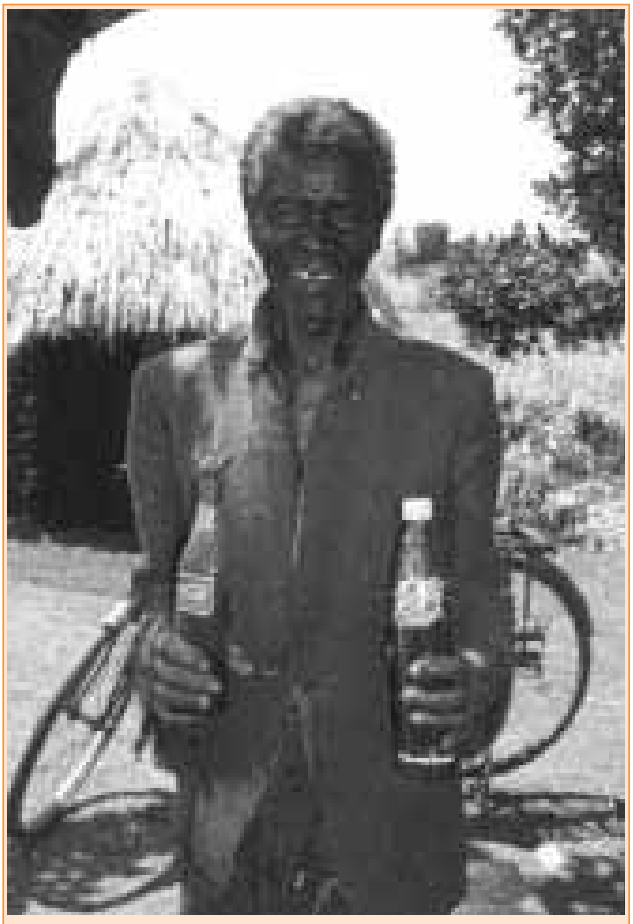

FIGURE 10 Honey is a traditional medicine or food in nearly all societies. Here in Uganda, it may be sold in a simple way at village level.

As an export crop

As standards of living rise, honey consumption increases. Most industrialized countries import honey to meet demand. This requirement can provide developing countries with a useful source of foreign exchange from

TABLE 1 **World honey production and trade, 1997**

	Production (tonnes)	Import (tonnes)	Value (US$1 000)	Export (tonnes)	Value (US$ 1 000)
Total	**1 112 000**	**317 630**	**539 820**	**264 701**	**453 546**
Argentina	65 000	171	336	70 422	108 361
Australia	26 000	30	70	13 287	22 159
Canada	29 000	1 992	3 279	8 408	17 054
China	188 000	2 296	2 393	48 306	69 200
Cuba	6 000	-	-	3 800	5
Ethiopia	31 000	-	-	1	5 000
Germany	12 000	83 295	130 383	13 061	33 406
Kenya	26 000	20	57	1	1
Mexico	54 000	135	246	26 900	41 090
South Africa	1 000	587	707	27	83
UK	3 000	21 223	37 282	904	2 430
USA	90 000	75 950	124 852	4 111	7 858

Sources: FAO Production Yearbook, Vol. 51; FAO Trade Yearbook, Vol. 51.
Note: This table lists only official figures; although exports from African and Asian countries are significant, they are unofficial.

FIGURE 11 Packaged in a more sophisticated way, honey generates income (Viet Nam).

honey exports. The countries with the highest honey exports are Mexico, China and Argentina. Each country has a large beekeeping industry that is an important part of their agricultural economy (see Table 1). All developing countries can export honey if production is in excess of local requirements. Because beekeeping does not use land, production of honey for export need not conflict with growing crops for local consumption.

As cultural food

Honey is widely used as a source of sugars for making honey wines and beers. Honey also has a high cultural value: eating honey or using it for anointing are part of many traditional birth, marriage and funeral ceremonies; this cultural connection is evident in the term "honeymoon". In the Masai society of East Africa, honey is used to pay the bride price; in Ethiopia, honey wine is brewed for weddings.

Beeswax – useful and valuable product

Beeswax is the material that bees use to build their nests. It is produced by young honeybees that secrete it as a liquid from special wax glands. On contact with air, the wax hardens and forms scales, which appear as small flakes of wax on the underside of the bee. About one million wax scales make 1 kg of wax. Bees use the wax to build the well-known hexagonal cells that make up their comb, a very strong and efficient structure. Bees use the comb cells to store honey and pollen; the queen lays her eggs in them, and young bees develop in them. Beeswax is produced by all species of honeybees, although the waxes produced by different species have slightly different chemical and physical properties.

Beeswax quality

Beeswax is valued according to its purity and colour. Light-coloured wax is more highly valued than dark-coloured wax, because dark wax is likely to have been contaminated or overheated. The finest beeswax is from wax cappings, which are the wax seals with which bees cover ripe honeycombs. This new wax is pure and white. The presence of pollen turns it yellow.

FIGURE 12 Beeswax.

Income from beeswax

For several reasons beeswax is an excellent commodity for rural communities to use as a cash or export crop.

- Beeswax processing is easy. Rendering beeswax to a quality suitable for export involves only simple heating and filtering methods to ensure that the beeswax is clean. It can be moulded into blocks using any suitably sized containers as moulds. The blocks are broken into small pieces to assure buyers that the beeswax is pure and clean.
- Transport and storage of beeswax is simple, because no special packaging is required. Beeswax is normally exported as small unwrapped lumps in hessian sacks.
- Beeswax does not deteriorate with age. Individual beekeepers or cooperatives can store small amounts until they have enough to sell.
- As with honey, beeswax can be considered an appropriate export crop for developing countries, because beekeeping does not use land required for local food production.
- In areas where most or all of the honey produced is consumed locally and where there is no major local use for beeswax, honeycombs are often discarded, even though they could provide additional income. Beekeepers sometimes need to be trained in methods of rendering and

FIGURE 13 Beeswax processing in Tanzania.

saving beeswax, and encouraged to sell their combined crop in one transaction.

Uses of beeswax

Beeswax has many traditional uses. In some countries in Asia and Africa, it is used in creating batik fabrics and in the lost-wax method of casting small metal objects. Beeswax is widely used as a waterproofing agent for wood and leather, and for strengthening threads; it is used in village industries such as candle-making and as an ingredient in ointments, medicines, soaps and polishes. Beeswax is in great demand on the world market. There are more than 300 industrial uses for beeswax. Cosmetics and pharmaceutical industries are the major users, accounting for 70 percent of the world trade, and require first-class beeswax that has not been overheated. The price ranges from US$4 to US$8 per kg. Other

TABLE 2 **World Trade in Beeswax, 1994**

	Production (tonnes)	**Export** (tonnes)	**Import** (tonnes)
Angola	1 500		
Argentina	1 500		
Australia	482	317	
Chile	500	264	
China	12 800		
Dominican Republic	350	206	
Ethiopia	2 100	210	
France			1 563
Germany			1 275
Japan			766
Kenya	1 050	1 615	
Korea	600		
Mexico	9 150		50
Portugal	375		
Spain	730		
Tanzania	1 050	437	
Thailand	2 302		
Uganda	780		
United Kingdom			421
USA	3 027		847

Source: Data from Bees for Development.
Note: A good deal of beeswax is exported from Africa by unofficial routes.

significant users are the beekeeping industries in industrialized countries that need beeswax for cosmetic foundations and for candle-making. Beeswax is used in the manufacture of electronic components and CDs, in modelling and casting for industry and art, in polishes for shoes, furniture and floors, in grafting waxes and in specialized industrial lubricants.

Industrialized countries use frame hives for beekeeping. Empty honeycombs are returned to the hive after the extraction of honey, which means that relatively little beeswax is harvested. With frame hives, the ratio of honey to beeswax production is approximately 75:1. Honey hunting or the use of traditional or top-bar hives results in greater yields of beeswax, however, the delicate honeycomb is broken during the extraction of honey and cannot be returned to the nest or hive. The ratio of honey to beeswax production using these hives is about 10:1. For this reason countries in Africa, Asia and Central and South America produce large amounts of beeswax, which can provide a valuable export crop (see Table 2). Beeswax is a valuable export commodity for Ethiopia, for example, and beekeepers in northwest Zambia harvest both wax and honey from bees nesting in bark hives as cash crops for export to Europe.

FIGURE 14 Traders in Pakistan discuss prices of beeswax harvested from wild bee colonies.

Other products from bees

In addition to honey and wax, bees will produce a number of other products all of which enjoy commercial markets. These include pollen, propolis and royal jelly.

Pollen

Pollen is valued as a health food; some people believe that it can help to combat allergies. It contains 30 percent protein, 30 percent carbohydrate, 5 percent fat and many minor constituents, so it is a potentially useful source of nutrition. Pollen is relatively simple to harvest from frame hives using a trap fitted to the hive entrance. When the bees pass through the trap, a grid knocks the pollen out of the pollen baskets on their back legs and it falls into a tray, from which it is collected. Pollen prices are high in Europe and East Asia.

FIGURE 15 Pollen ready for harvest.

Propolis

Honeybees collect resins and gums from buds or injured areas of plants. This glue-like substance, usually dark brown in colour, is called propolis. As with honey, propolis differs in composition according to the plants from which bees have been collecting. Honeybees use propolis to keep their homes dry, draught proof, secure and hygienic. Propolis is used to seal up any cracks where micro-organisms could flourish; its volatile oils must serve as a kind of antiseptic air-freshener. Bees use propolis:

- as building material to decrease the size of nest entrances and to make the surface smooth for passing bee traffic;
- to varnish inside brood cells before a queen lays eggs in them,

providing a strong, waterproof and hygienic unit for developing larvae;

- to embalm the bodies of mice or other predators too large for bees to eject from the nest, which would otherwise decay and be a source of infection.

The *Apis florea*, one of the Asian honeybee species, uses rings of propolis like bands of grease to coat the branch from which its single-comb nest is suspended as a protection from predators. Propolis has long been used as a medicine; it has been proved scientifically that propolis kills bacteria. It is a common ingredient in toothpaste, soaps and ointments. Dissolving propolis in alcohol makes a tincture with many claimed medicinal properties. Propolis can be a useful income source: its current world price is about US$10 per kg. For beekeepers in remote areas, access to markets is more of a problem than harvesting the product.

Royal jelly

Royal jelly is the food that worker bees give to freshly hatched larvae. It contains many insect growth hormones and is valued as a medicine,

FIGURE 16 Since the 1970s, royal jelly harvested from European races of honeybees has been an export crop for beekeepers in Thailand.

tonic or aphrodisiac in various parts of the world. Royal jelly has many different components including proteins, sugars, fats, minerals and vitamins.

Under natural conditions, a larva destined to become a queen bee develops in a special large wax cell, inside which worker bees place large amounts of royal jelly. Honeybee colonies can be manipulated by beekeepers to start producing great numbers of queens, perhaps 50 or more, specifically to produce royal jelly for harvest. Worker bees produce vast amounts of royal jelly – extra sugar must be fed to the colony to achieve this – and place it in the queen cells. Instead of feeding on it and developing into queen bees, the larvae are removed and the royal jelly is harvested by beekeepers.

Harvesting royal jelly and its subsequent processing and packaging call for skilled techniques of honeybee colony manipulation and sophisticated technology. Royal jelly deteriorates quickly after harvest and must be kept frozen or freeze-dried during handling, storage, transport and marketing. The main countries harvesting royal jelly commercially are China, Taiwan and Thailand. The main market for royal jelly is Japan; relatively small amounts are imported by other industrialized countries.

Value-added products

It is to the advantage of producers to find ways of adding value to bee products, as opposed to selling only the raw products. The manufacture of value-added products from beekeeping can involve various groups, some of whom may not be interested in actually keeping bees or have the means to do so. Honey, beeswax, pollen or propolis can be used in a variety of foods, cosmetics, ointments and other goods that can be made and sold locally, creating more livelihood opportunities.

Beeswax provides an excellent material for making high-quality soap. The main difficulty in soap production is obtaining and safely handling caustic soda (sodium hydroxide), which is an important ingredient. In some villages, people know the techniques required to produce ash for making caustic soda, and these methods can be used. There are many traditional ways of making soap that can be modified and improved by including beeswax. Beeswax used in soap must be of excellent quality – pure, golden or pale yellow in colour and not damaged by heat. If it is neatly made and attractively packaged, beeswax soap can bring a good price at market and is a popular product for sale to tourists.

It is easy to make profits from beeswax by manufacturing ointments or cosmetics. It is essential to work in hygienic conditions, and to have good knowledge of the ingredients and products and access to small containers for packaging and marketing. Making wax candles may be the easiest way to increase profits

FIGURE 17 Using beeswax in the lost-wax casting method to make small metal ornaments for sale to tourists in Ghana.

from harvested beeswax. In developing countries with tourist industries, batik art and small metal ornaments made by lost-wax casting – both processes use beeswax – can create livelihoods for artisans.

FIGURE 18 Using beeswax in batik work. (Malaysia).

Apitherapy: healing with bee products

It is said that the word "medicine" derives from "mead" (honey wine). Whether or not this is true, honey and the products of bees have long been used as medicine. Countries in Asia and eastern Europe have a wealth of traditional knowledge of apitherapy – the healing properties of bee products. In recent years, there has been a worldwide revival of interest. Honey, beeswax, propolis and bee venom, used in bee-sting therapy, are the main bee products used in apitherapy.

Honey has antibiotic properties: it is a sterile solution with a high sugar concentration that prevents the growth of micro-organisms. It is highly acid. It contains enzymes which produce hydrogen peroxide that kills bacteria. Honey is good for healing wounds and for skin treatment: its hygroscopic property is good for drying out wounds, and its permeability allows oxygen to pass through it.

FIGURE 19 Propolis for sale in Brazil.

Propolis also has medicinal properties: the gums and resins that bees gather from plants for propolis are the very substances exuded by plants for their own protection and healing.

FIGURE 20 Wide range of bee products for sale.

In brief: how to keep bees

Honey hunting, or plundering the nests of wild honeybees to obtain honey and beeswax, is practised throughout the world wherever colonies of wild nesting honeybees are abundant. It has been known for thousands of years, however, that obtaining honey is easier and more convenient if bees are encouraged to nest inside a hive. This housing of bees in a container is true "beekeeping", but the term is used loosely to describe all the techniques involving bees and the harvesting and processing of their products. There are many ways to utilize honeybees for their pollination services or to obtain products from them. The methods used will be determined by the types of bees available, and the skills and resources available to the beekeeper.

Obtaining bees

Bees can be obtained by transferring a wild nesting colony to a hive. The wild colony will already have a number of combs, which can be tied to top-bars or into the frames of a hive. Another way to get started is to set up a hive, perhaps rubbed inside with some beeswax to give it an attractive smell, and wait for a passing swarm of bees to occupy it. This will only be successful in areas where there are still plenty of honeybee colonies. The best way to start is with the assistance of local beekeepers.

During the last quarter of the twentieth century, bee diseases were spread around the world as a result of people moving honeybee colonies; there were serious consequences for the beekeeping industries in some countries. The few regions without introduced honeybee diseases are mainly in developing countries. It will be beneficial if these countries can retain their stocks of disease-free honeybees. Honeybee colonies, or even single queen bees, and used beekeeping equipment must never be moved from one area to another without expert consideration of the consequences.

Choice of hives

Beekeeping does not need to take up valuable land. Depending on type, hives may be placed in trees, on scraps of wasteland or flat rooftops. This makes beekeeping feasible for smallholders and landless people. A good site should have a water source

nearby, plenty of flowering plants and trees in the area and shelter from wind and strong sunlight. A hive is any container provided for honeybees to nest in. There are three main types: traditional hives, movable-frame hives and top-bar hives.

Traditional hives

These are made from local materials such as hollowed-out logs, bark formed into a cylinder, clay pots, woven grass or cane – whatever is suitable and available. The sole purpose of the hive is to encourage bees to nest in a place accessible to the beekeeper. The bees build their nest inside the hive, just as they would build it in a natural cavity. The beekeeper plunders the nest to obtain crops of honey and beeswax. Bees may or may not be killed during this process, depending on the skill of the beekeeper. If the colony is destroyed, the hive will remain empty for a while. If there are plenty of honeybee colonies in the area, a swarm may eventually settle in the empty hive and start building a new nest. Traditional beekeepers often own many hives and expect only a portion to be occupied by bees at any one time.

All the materials required should be locally available, but traditional beekeepers can benefit from assistance in obtaining protective clothing,

FIGURE 21 Traditional local hives made from logs in Bhutan.

FIGURE 22 End removed to show inside a traditional hive: the bees build their combs from the top of the hive.

smokers and containers for the honey, and help in locating markets for their products.

Top-bar hives

Top-bar hives have the same advantages of manageability and efficiency in harvesting honey as movable-frame hives, without the disadvantage of high manufacturing costs. To make the hives manageable, bees are encouraged to construct their combs from the undersides of a series of bars. These bars allow individual combs to be lifted from the hive by the beekeeper. As with traditional local hives, the container for the hive may be constructed from whatever materials are locally available. Many different designs have been published (see Aidoo, 1999 and Sakho, 1999).

All equipment can be made locally. The only items that need to be constructed with precision are the top bars, which must provide the same spacing for combs in the hive that the bees would use in the natural nest. This spacing will depend upon the species and race of honeybee. As a very general guide, the width of top bars needed for *Apis mellifera* of European origin is 35 mm, *Apis mellifera* in Africa – 32 mm and *Apis cerana* in Asia – 30 mm. The best way to

FIGURE 23 Top-bar hive beekeeping in Cape Verde.

FIGURE 24 Top bar and comb.

determine the optimum width is to measure the spacing between combs in a wild nest of the same bees. The volume of the brood box should be roughly equal to the volume of the cavity occupied by wild nesting honeybees.

An advantage of this type of equipment is that it opens up beekeeping to new groups of people. In some countries, traditional beekeeping tends to be an activity for men only, who use hives made from bark, kept deep in forests. Groups of women beekeepers may prefer to begin beekeeping with top-bar hives that can be made and kept close to home. Top-bar hives can also be an

FIGURE 25 Top-bar hive in Nepal.

inexpensive way of housing large numbers of colonies for pollination purposes.

Movable-frame hives

These hives are used in most industrialized countries and some developing countries, especially in Central and South America and Asia. Rectangular wood or plastic frames are used to support the combs. These frames have two major advantages.

- They allow for inspection and manipulation of colonies, such as moving frames of bees or honey-filled frames (stores) from a strong colony to strengthen a weaker one.
- They allow for efficient harvesting of honey, because the honeycombs in their frames can be emptied and returned to the hive, which allows increased honey production because the bees do not have to build fresh combs.

Frame hives consist of a series of boxes, usually of wood, stacked on top of one another. Frames are arranged in the boxes like suspension files in a filing cabinet. The bottom box is usually used for the brood nest, which is where the queen lays her eggs and young bees develop. A queen excluder – a metal grid with holes that allow worker bees to pass through but not the larger queen – is placed between the box with the brood and the box above it. This ensures that only honey is stored in the boxes above the queen excluder. A hive stand, floor and roof are required, along with various other specialized items of equipment.

Frame hives must be constructed with precision. Boxes must fit together precisely and the spacing between frames must be the same as in a natural nest. Frame hives require seasoned timber that is accurately cut and planed and materials such as wire, nails and foundation. They are therefore relatively labour-intensive to make and maintain. There must be access to replacement parts, particularly foundations and frames. The spaces

between combs, nest volume and other features of standard frame hives have been developed for use with European honeybees in Europe, North and Central America and Australasia and are not necessarily suitable for other races and species of honeybees. When buying equipment it is important to have an understanding of the honeybees to be housed and the specifications of the equipment offered.

FIGURE 26 Beekeepers with their frame hives in Albania.

Beekeeping equipment

Smoker

A smoker provides beekeepers with a source of cool smoke needed to calm the bees. The smoker consists of a fuel box containing smouldering fuel such as dried cow dung, hessian, maize cobs or cardboard, and has a bellows attached. The beekeeper puffs a little smoke near the entrance of the hive before it is opened and gently smokes the bees to move them from one part of the hive to another. Imported smokers are useful as prototypes, but smokers can be manufactured by village blacksmiths, which adds to local livelihoods.

FIGURE 27 Equipment for small-scale beekeeping should be made locally: a manufacturer of smokers in The Gambia.

Protective clothing

A broad-brimmed hat with a veil protects the head and neck from stings. Protective clothing gives beginner beekeepers confidence; more experienced beekeepers find that wearing too much protective clothing makes them hot and the bulk makes it difficult to work sufficiently gently with the bees. Some beekeepers merely put a plastic bag over each hand, secured at the wrist with a rubber band. Rubber bands also prevent bees from crawling up trouser legs or shirtsleeves. Imported clothing can provide useful prototypes, but beekeeping clothes – basically modified overalls – can be made locally, thus providing a useful stimulus for local industry.

Hive tool

Some bee species tend to close every gap and seal every joint in the hive with propolis. The hive tool is a handy piece of metal used to separate boxes,

scrape off odd bits of beeswax and separate frame-ends from the supports. It is possible to use an old knife for this job, but knife blades tend to be too flexible and give insufficient leverage. Village blacksmiths can easily produce suitable implements.

Harvesting and processing

Honey is harvested at the end of a flowering season. In traditional or top-bar hives, the beekeeper selects combs which contain ripe honey covered with a fine layer of white beeswax, usually those nearest the outside of the nest. Combs containing pollen or developing bees are left undisturbed. Honeycomb can be simply cut into pieces and sold for a premium price as fresh cut-comb honey. Alternatively, the honeycomb can be broken and strained through muslin or another form of filter to separate the honey from the beeswax. After the honey has been separated from the combs, the beeswax can be melted gently over water into a block. Honeycombs harvested by honey hunters can be processed in the same way.

Honey is obtained from frame hives by spinning the frames in a centrifugal extractor. The empty honeycombs are then returned to the hive. Because the combs are recycled, bees put effort into honey production rather than beeswax comb production. This explains why the beeswax yield from frame-hive beekeeping is low compared to traditional beekeeping methods.

Promoting beekeeping projects as a source of livelihoods

There are many different entry points for projects to strengthen livelihoods with beekeeping, such as including trees for bees within planting schemes to improve pollination and increase crop harvests, assisting honey hunters through beekeeping or making and marketing honey wines or beeswax cosmetics. Beekeeping projects have been started in many developing countries and are frequently supported by international organizations, governments or NGOs. Beekeeping fits in well with other interventions and is often incorporated as one of a number implemented. Some minimum resources, however, should normally be available to people.

Natural resources: indigenous species

Beekeeping projects can improve the potential for beekeeping by planting melliferous vegetation. Indigenous honeybees have evolved and survived successfully under local conditions and will be better suited to them than introduced bees. The European honeybees introduced into many countries and African bees introduced into Central and South America currently form the basis of successful beekeeping industries.

Human resources: beekeeping skills, training and extension

Beekeeping is a widespread activity with a wealth of existing local knowledge and skills. The addition of a little technical information, however, can lead to greatly improved harvests of honey and beeswax. There are many ways to assist honey hunters or beekeepers to build on their resources to create more income by harvesting and processing honey more skilfully, and to obtain better prices by saving and selling beeswax and by making secondary products.

Beekeepers and trainers often lack appropriate training materials – most of the literature discusses keeping European bees in temperate zone conditions. Training is often theoretical rather than practical, placing emphasis on changing the type of hive used without providing practical guidance and follow up. New beekeepers need training in how to work with bees, how to maintain honey quality, how to separate honey from beeswax, how to

render beeswax, how to manufacture secondary products and how to make beekeeping clothes and equipment.

FIGURE 28 Ethiopian beekeepers carrying their honey to market. Lack of access to transport and markets is usually the major constraint for beekeepers in remote places.

Physical resources: equipment and transport

Limited access to transport is the main reason why beekeepers in remote areas receive the lowest prices for their products. Projects can do much to alleviate this problem. Rural people can find it difficult to obtain equipment, containers and packaging. The answer is not merely to donate the items but to train local people to make their own equipment and find access to good containers and packaging, and credit with which to acquire them.

The equipment needed for beekeeping can be simple: the humble plastic bucket is one of the most essential items. Recommending good-quality, lidded, stackable plastic buckets may not bring great professional kudos to the beekeeping expert, but such buckets are useful for beekeepers living in remote places who need to keep their honey clean until they are able to sell it. Honey of excellent quality can be harvested as long as clean buckets are available, along with cotton or baskets for sieving honey and containers for melting wax and packaging the honey and other products.

The appropriate equipment for harvesting and processing honey and beeswax depends on the quantities to be processed and the type of product required. In some areas, beekeeping using traditional local hives is practised on a large scale and justifies the provision of relatively sophisticated, large-scale processing equipment capable of dealing with honey in bulk. Where a cooperative has established a honey-packing unit, a few specialized items often have to be imported, such as effective taps for use on honey containers, special gauze for filtering honey and refractometers to measure water content.

Financial resources: credit

In poor societies, lack of credit is a major constraint to everyone concerned with selling and buying honey. Beekeepers with honey to sell expect to receive cash from honey-collection centres or private-sector traders; otherwise they prefer to sell their honey in small quantities in markets to obtain an instant but low cash return. People buying honey need access to credit during the honey season. Lack of credit leads to insignificant volumes of honey being available for sale, no interest from traders and a stagnant industry.

Social resources: sector support and marketing

In poor countries, there are usually government officers responsible for training and extension in beekeeping. Often, however, they have little relevant training and lack access to transport and other resources. National policies are needed to promote apiculture and protect pollinators. A national NGO is a considerable advantage and able to represent the interests of beekeepers, establish communication between producers and traders and facilitate marketing.

In many developing countries, much can be done to increase retail honey sales, for example, by improving and diversifying packaging, especially for small volume markets. Marketing initiatives can involve promoting honey in the media, interacting with consumers and traders to increase honey consumption and sales, and creating links with packaging suppliers. Honey consumption increases according to living standards; people are keen to buy honey when it is well presented and they have more confidence in the product.

The first aim of a marketing initiative should be import replacement, which means ensuring that local

Project planning

- Establish the most effective entry point for a beekeeping intervention, for example, by providing assistance with technical aspects of beekeeping or product marketing.
- Ascertain that the planned intervention is appropriate for the people concerned.
- Recognize that beekeepers are often the poorest people in local society and may live in remote places; focus the intervention to reach them.
- Determine that the producer groups will have market access, if more honey and beeswax are harvested.

honey is packaged and presented as attractively as the imported brands. Only when the local need for honey is satisfied should export be planned, as inexpensive honey is readily available on the world market. In some countries, producers have benefited from having their honey or beeswax certified as organic or produced according to fair-trade criteria. This type of certification can help small-scale producers to find niche markets that pay premium prices. Honey export to the European Community requires expert knowledge of trade rules and import requirements (Bradbear, 2001).

Project evaluation

Many beekeeping projects have involved the distribution of hives and equipment and the provision of technical training. Donors and local leaders might be satisfied with the outcome of such projects when shown convincing numbers of new hives installed in new apiaries. Closer examination, however, often reveals that hives of a newly introduced technology are not always used efficiently. Good training and follow up are essential. Beekeeping is a seasonal activity, and it cannot be learned in the classroom. The true test of success in any beekeeping development project

FIGURE 29 Many beekeeping projects have introduced technology the use of which could not be sustained after the end of the project. Here, a storeroom full of unused equipment is all that remains from a project that depended on imported equipment and materials.

should not be "How many hives were distributed?" but "Were people's livelihoods strengthened?"

Small interventions such as beekeeping projects are not always popular with donors. In poor societies, however, large beekeeping projects with high capital input are frequently doomed to failure. In far too many beekeeping projects, a well-meaning donor has allocated a significant budget to a project, a large portion of which is inevitably intended for equipment. This has led to equipment being introduced that is not always appropriate to the resources available, such as imported woodworking machinery for making hives that may become unusable as soon as a spare part is needed. Training is sometimes irrelevant to local resources and knowledge.

Frame-hive equipment should not be used unless the infrastructure exists for manufacturing it locally. Frame-hive beekeeping is practised in all industrialized countries and many projects have tried to introduce this type of beekeeping in poor countries. It is essential that the a community have the physical, human, natural and financial assets to support this type of beekeeping, if such a project is to succeed.

Case study of an individual bee farmer: Gladstone Solomon, Tobago

My grandfather was a self-employed cocoa farmer and agriculture always attracted me. But not having been prepared for cutlass-and-hoe farming, I had to find a less rigorous activity. Gazing at a honeybee landing on a dew-soaked flower early one morning awakened a sense of destiny within me. I knew then that I would eventually become a beekeeper.

A three-day introductory course at the Farmers' Training Centre in Trinidad gave me my first exposure to beekeeping. This was supported by practical sessions at the Apiaries Unit Tobago with two of the island's more experienced beekeepers. After this I started beekeeping with two nucleus hives.

I read anything on the subject and made contacts with as many beekeepers as possible. A British beekeeper who visited the island on several occasions was particularly helpful, not only to me but to the island beekeeping community, which was organized as a cohesive and vibrant group: The Tobago Apicultural Society.

My wife Sharon and I now manage approximately 70 colonies and market honey (extracted and chunk), beeswax, pollen and – the latest addition to our product line – handcrafted soaps with beeswax and honey. Our three sons earn pocket money by assisting in various aspects of the business.

July, 2001

FIGURE 30 Gladstone Solomon harvesting honey.

Case study of a project for beekeepers in Uganda: Joy Mugisha, the UWESO UK Trust

Our first project was in the Luwero District, an area severely ravaged during the civil war. Beginning in 1995, participants were trained in the production of honey and beeswax, equipment was provided and a honey-processing centre was installed. The project is now self-sustaining.

Typically, a trained project officer from the NGO Uganda Women's Effort to Save Orphans (UWESO) provides training, advice and starter equipment to families supporting orphans and chosen by the local UWESO branch. The beekeepers develop the hives and gradually increase the number, so that after two or three years a family may be operating about 30 hives. Each hive should produce two crops of honey and wax each year, which can be taken to the UWESO collecting centre and sold to local companies for local and export markets. This can provide a return of perhaps US$1 400 in a year – well above the average family income level in rural areas.

The cost of such a project to the Trust is about US$140 000 including the costs of the project officer, equipment and a collecting and processing centre. If 150 families can each increase their annual earnings by US$1 400 - the return on the single investment of US$140 000 is, amazingly, about US$210 000 each year! Even if some families underperform, the financial returns amply justify the investment.

July, 2001

FIGURE 31 The UWESO honey and beeswax collection centre at Lyantonde, Uganda.

FAO project example – Iraq: requirement for technical assistance

In 1995 the Iraq Beekeepers' Association approached the United Nations Food and Agriculture Organization (FAO) for assistance. Members expressed their concern about the widespread deaths of honeybee colonies in Iraq.

During the 1970s and 1980s, beekeepers in Iraq practised sophisticated beekeeping, depending largely on imported equipment and stocks of honeybees. This ended following the enforcement of United Nations sanctions in 1991. Beekeepers were no longer able to import the beeswax foundation used in frame-hive beekeeping. Lack of beeswax and equipment to make foundation led to the use of contaminated material and a build-up of disease in honeybee populations. The isolation of Iraq meant that beekeepers were unaware of the rapidly changing status of bee disease and current methods of control, especially of the predatory mite Varroa.

FAO provided technical assistance to help identify and control honeybee diseases and mites, and to support local manufacture of clean stocks of beeswax foundation.

FIGURE 32 Making fresh beeswax foundation, Iraq.

FAO project example – St Vincent and the Grenadines: requirement for sector support

The St Vincent Ministry of Agriculture recognized the need for local farmers to diversify beyond banana production. In 1996, they requested FAO assistance to encourage farmers to take up beekeeping. This assistance would ensure adequate stocks of bees for pollination of alternative new fruit crops, and would enable some farmers to create income from beekeeping.

FAO assistance came in the form of capacity-building: training ministry staff in beekeeping, establishing demonstration apiaries for farmers, developing a training programme, encouraging local manufacturers to begin making beekeeping equipment and proposing policies for protecting the beekeeping industry. St Vincent currently enjoys the rare situation of disease-free stocks of bees.

FIGURE 33 Making beekeeping clothes in St Vincent.

FAO project example – Afghanistan: assistance for people living under stress

Beekeeping has traditionally always been a successful part of Afghan agriculture, with many fruit and oilseed crops requiring pollination by bees. The current war situation in Afghanistan has led to restrictions on movement and loss of resources and opportunities for livelihood creation. Despite the lack of resources, beekeeping remains a livelihood option, because bees are available and equipment can be made locally.

FAO provided training for women and men beekeepers. Since beekeeping can be practised in a home compound, beekeeping was regarded by the Taliban regime as an acceptable activity for women in Afghanistan. In addition to harvesting honey, a highly valued food under current circumstances, the women learned to make skin ointments and other secondary products useful for people living in harsh and isolated conditions. Men and women have been given training in making all the equipment needed for frame-hive beekeeping, so that they can continue without need for external inputs.

FIGURE 34 Training Afghan beekeepers: in the first part of the course trainees made their own veils.

Case study: disabled beekeepers – agro-industries development

Disabled people face particular difficulties in earning sufficient income. For much of their lives, they remain dependent on a caring family and the society around them. In poor communities where sufficient resources are never available, disabled people frequently become marginalized and forgotten, and they may lose confidence in themselves.

An NGO in Mauritius has shown that this need not be so. It has trained many disabled people in the country to become practical beekeepers and has set up a network of community producers. In 1997, Craft Aid of Rodrigues established a model apiary as part of its honey department. It provides the organizational skills training that supplies beekeepers with equipment, materials and information, and buys surplus honey and wax for processing and sale. The department has a staff of nine, more than half of whom are handicapped. They target the tourist trade and selected overseas retail markets to sell honey and other products that match the highest international standards. They have won medals at the prestigious National Honey Show held in London each November. Training, production and sales are profitable.

Craft Aid recently shared its experience with the publication of a booklet entitled *Small enterprise development*, which is available on the FAO website; for more information check out the Craft Aid website.

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Some apicultural terms

Apiary	The location of a number of colonies.
Apiculture	The science and art of bees and beekeeping.
Apis	The genus to which honeybees belong.
Apis cerana	An Asian species of honeybee that can be kept inside hives.
Apis dorsata	The giant or rock honeybee, indigenous to Asia.
Apis florea	A species of honeybee indigenous to some parts of Asia and the Middle East. It nests in the open and cannot be kept inside hives.
Apis mellifera	The honeybee species indigenous to Africa, Europe and the Middle East. European races have been widely introduced to other areas, including the Americas, Asia, Australasia and the Pacific. African races have been introduced to South America and have spread to Central America and the United States.
Bark hive	A hive made from the bark of trees.
Batik	A technique for producing designs on cloth by putting wax on those parts of the cloth to be protected from dye.
Bee space	A gap large enough for bees to walk and work in, for example, the space between two parallel combs or between a comb and the wall of the hive.
Beeswax	Wax produced by honeybees, secreted by special glands on the underside of the abdomen, and used to build comb.
Box hive	One of the many types of hives used to keep bees.
Brood	All stages of immature honeybees: eggs, larvae and pupae.
Cell	A single hexagonal wax compartment, the basic unit of a comb. Each honeybee develops in a cell. Honey and pollen are stored in cells.
Chunk honey	See cut-comb honey.
Colony	Honeybees are social insects; they live only as part of a colony and not individually. Each colony of honeybees contains one queen bee who is the female parent of the colony, a few hundred drone bees and thousands of worker bees.

Comb	The wax structure made of hexagonal cells in which honeybees rear young and store food.
Cross-pollination	The transfer of pollen between flowers of different plants of the same species. Plants that are not self-fertilizing must be cross-pollinated before they can develop seeds. Many crops depend on cross-pollination by insects.
Cut-comb honey	Pieces of honeycomb containing honey and presented for sale with the honey still in the comb.
Diversity	The number of plant and animal species in an area.
Drone	A male honeybee. Drones undertake no work within the hive: their sole function is to fertilize the queen.
Extractor	The centrifugal machine in which honey is spun out of cells in frames of honeycomb.
Fair trade	Development charities have agreed international standards of fair trade for commodities produced in poor countries. Member organizations cooperate in awarding fair trade marks and labels to products that meet fair trade criteria. Issues include freedom of association, working conditions, wage levels and use of child labour. In addition to honey and beeswax, the products include coffee, chocolate, orange juice, tea, sugar and bananas.
Fixed-comb hive	A hive in which bees build their nests with the combs attached to the wall of the hive. The combs cannot be detached from the hive without breaking them.
Forage	Flowering plants that provide nectar and pollen for bees.
Forager	A worker honeybee that collects pollen, nectar, water or propolis for the colony.
Foundation	A thin sheet of beeswax embossed with the hexagonal pattern of a comb. A sheet of foundation is placed in each wooden frame and serves as a base on which honeybees build their comb. This accelerates the process of comb construction. Without foundation, honeybees would not necessarily build their comb in the orientation required by the beekeeper.
Frame	A rectangular wooden frame that holds a sheet of wax foundation. A number of frames hang parallel to one another inside the hive.

Frame hive	A hive that contains frames. The honeybees are encouraged to build their combs in these frames. The frames then enable combs to be lifted from the hive for examination, which allows the recycling of combs.
Granulated honey	Honey in which some of the sugars have crystallized.
Hive	Any container provided by people within which bees can build their nest.
Honey	Nectar or plant sap ingested by bees, concentrated by them and stored in combs.
Honey hunting	Plundering wild bee colonies for their honey.
Honeybees	Species of bees belonging to the genus *Apis*. All are social bees that store significant quantities of honey.
Livelihood	A way of making a living.
Local hive	A hive made from local materials; often a fixed-comb hive.
Lost-wax casting	A technique for making an object by casting it in molten metal. The model is created in wax then covered with a shell of clay. The wax model and its clay coat are then fired to harden the clay and melt the wax. The wax is then poured out and replaced by molten metal.
Low-technology hive	A hive that is simple, cheap, reliable and repairable.
Meliponinae	The subfamily to which all stingless bees belong.
Movable-frame hive	A hive containing frames.
Nectar	A sweet liquid secreted by flowers. It is a watery solution of various sugars.
Nest	The home of a bee colony where bees live on their comb or combs.
Nucleus	A small colony of bees created by a beekeeper from an existing colony or colonies; it is used to increase colony numbers or to rear queens and breed bees.
Organic honey	Generally taken to mean honey that is free from any residues of pesticides, fertilizers, drug treatments or heavy metals.
Pollen	The fine dust-like substances that are the male reproductive cells of flowering plants. Collected by bees as a food source.
Pollination	The transfer of pollen from the anther of a flower to the stigma of the flower, or the stigma of another flower.

Pollination agent	Bees act as pollination agents when they transfer pollen from one flower to another. Apart from insects, other agents that may bring about the transfer of pollen are wind, gravity, nectar-seeking birds and bats.
Propolis	Plant resins collected by honeybees and used by them to seal cracks and gaps in the hive.
Protective clothing	Clothing to protect beekeepers from being stung by bees.
Queen	The female parent of the colony; the only sexually developed female.
Refractometer	An instrument used to measure the refractive index of honey, and from which sugar concentration and water content can be calculated.
Sustainable development	Development that meets the needs of the present without compromising the ability of future generations to meet their own needs - as defined by the Rio Declaration on Environment and Development at the 1992 United Nations Earth Summit.
Sustainable livelihoods approach	A way of thinking about objectives, scope and priorities for development; an approach to understanding the nature of poverty and to implementing and assessing poverty-reduction interventions.
Top bar	A piece of wood on which honeybees build their comb in a top-bar hive.
Top-bar hive	A hive containing top bars. Honeybees build parallel combs suspended from a series of parallel top bars; this enables the beekeeper to lift individual combs from the hive for inspection or to harvest honey, as with frame hives.
Traditional hive	This usually means a hive made according to local tradition. Most traditional hives are fixed-comb hives.

Further information
websites, books, videos and CDs

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Organizations for beekeepers

Apimondia

Apimondia is the World Federation of Beekeepers' Associations. The Apimondia congress, organized every two years, is the major international event for everyone involved with any aspect of beekeeping. Apimondia publishes a quarter journal, *Apiacta*, that contains bee research for beekeepers. Apimondia can assist with information on any aspect of apiculture. Further information from:

Apimondia
Corso Vittorio Emanuele II, 101
00186 Roma
Italy
Fax: +39 06685 2287
E-mail: apimondia@mclink.it
Website: www.apimondia.org

Asian Apiculture Association (AAA)

The AAA organizes a conference in Asia every second year, and alternates with the Apimondia congress. The AAA operates a network of Asian beekeepers. Further information from:

Asian Apiculture Association
Honeybee Science Research Centre
Tamagawa University
Machida-Shi
Tokyo 194 8610
Japan
Fax: +81 427 398 854
E-mail: HSRC@agr.tamagawa.ac.jp

*Bees for Development (***B***f***D***)*

Bees *for* Development is an NGO based in the United Kingdom that assists beekeepers in developing countries. B*f*D organizes training, provides information and publishes the international journal *Beekeeping & Development*. Further information from:

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