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AN EXPLORATORY CASE STUDY OF BEEKEEPING DEVELOPMENT IN KENYA
The Role of Indigenous Knowledge in Achieving Sustainability

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ABSTRACT:

The people of Kenya have been keeping bees for centuries. Beekeeping provides an important source of food for rural communities, contributes to many pastoralist and nomadic livelihoods, and holds an important place in Kenyan traditions and rituals. In recent decades western development agencies have targeted beekeeping as an activity that holds the potential to reduce poverty in rural Kenya. The general attitude towards beekeeping development focuses on increasing production and marketability of honey and wax products so as to generate income and thus alleviate poverty. The ideology that supports this development work is largely driven by economic indicators and often measures success by an increase in production. The traditional style of keeping bees in hollowed logs hung from trees is widely viewed by development agencies as inefficient and backwards. Due to this perspective on traditional beekeeping, technology transfer has dominated the efforts of many development agencies under the assumption that the western method of keeping bees with moveable frame hives (Langstroth and Kenyan Top Bar Hives) is more efficient and profitable for honey producers.

However, the extent to which new beekeeping technology has improved rural livelihoods and alleviated poverty is not fully understood. Many questions remain regarding the sustainability of western technologies being adopted by rural Kenyans and the environmental and biological impact of introducing these potentially incompatible technologies. Development that is approached through a purely economic lens risks overlooking the cultural and environmental dimensions of beekeeping. There are many reasons to believe that there should be a greater focus on developing environmentally sustainable practices for Kenyan beekeepers. As with any livelihood strategy that relies upon the health of another organism, whether plant or animal, beekeeping can only be sustainable for humans if it is sustainable for the bees as well.

Working towards a more productive and environmentally sustainable method of beekeeping requires a profound and complete understanding of the local history and culture. Engaging with local communities and gaining insight through their experiences, practices, and knowledge should be of the utmost importance. It is also necessary to understand and respect the biology and nature of the African bee. Indigenous beekeeping knowledge in Kenya is largely underutilized, and there is little unified effort to preserve and propagate the practices of traditional beekeeping. There are various examples of successful development projects around the world that utilize indigenous knowledge in their efforts, some of them even focusing on beekeeping. I will argue that the same approach should be taken with beekeeping in Kenya in order to encourage more sustainable, and environmentally conscious development.

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SECTION 1: INTRODUCTION

The relationship between *Homo sapiens* and *Apis mellifera* dates back to the Paleolithic Age, nearly 2.5 million years ago, when man first realized the sweet bounty to be harvested from the honeybee hive (Crane, 1999). Throughout the ages, the various products of honeybees, including honey, wax, pollen, and propolis, have held high value in almost every culture, and are now widely traded in international markets. In addition to their products, honeybees are the greatest source of agricultural pollination worldwide (Free, 1993). Due to the economic and agricultural importance of beekeeping, it is now highly valued by international development agencies as a means of stimulating economic growth and export (Ibid, 1999).

In Kenya, this trend in beekeeping development has been building momentum for decades, drawing attention from development organizations worldwide. Apiculture holds great potential for rural farmers looking to diversify their source of income, and if further developed, for tapping into world markets. However, while there are ample economic gains to be realized by beekeepers in Kenya, the environmental impacts of their interactions with the African honeybee remain largely overlooked. As the Western world experiences an unsettling decline in honeybee survival rates, it is of the utmost urgency that the environmental and biological consequences of honeybee management are brought into scrutiny. As researchers, fellow beekeepers, and citizens of the earth, it would be irresponsible to not give more serious consideration to the implications of our relationship with the honeybee.

With this in mind, there is an urgent need to refocus our efforts to be more environmentally and biologically sustainable as we move forward with Kenyan beekeeping development. The principles of sustainable development give weight to the environmental implications of our actions, with the ultimate goal of creating long-lasting solutions. Crucial to

uncovering a more sustainable way forward will be the integration of indigenous knowledge in our approach to beekeeping. There is a vast amount of traditional knowledge that can be gleaned from the indigenous peoples of Kenya, which holds invaluable insight and guidance for future sustainable development efforts. The link between sustainability and indigenous knowledge will be explored in the final section. The following sections are laid out as follows: Section Three explores the initial stages and current status of beekeeping development in Kenya, followed by a discussion of the economic growth ideology that supports these efforts. Before we can begin to map the future, the historical context of beekeeping and development must be understood, and critiqued. Section Four will introduce the idea of sustainable beekeeping development, specifically emphasizing the environmental and biological realms of sustainability. Section Five will present a case for indigenous knowledge and the invaluable role it holds in sustainable development work. This claim is then substantiated by a review of case studies from around the world that show successful integration of indigenous knowledge into the development model. To conclude, I will summarize the key points made, note possible barriers to moving forward, and offer recommendations for the future of sustainable beekeeping in the sectors of research, government policy, and development projects.

SECTION 2: WHY BEES? WHY KENYA?

As the western world witnesses a rising standard of living, there has been a simultaneous awakening to the glaring disparity between developed and underdeveloped regions of the world, between the haves, and the have-nots. Spurred by a newfound sense of social obligation and resolve to share the secrets of Western economic success with others, the campaign to amplify development to a worldwide scale was ignited. International economic development became a leading agenda in foreign economic policy, holding promises of better and brighter futures for those beleaguered by poverty, malnutrition, poor health, and social inequalities (McMichael, 2008). Economic development became widely viewed as the most appropriate means to an end; that end being the betterment of society; an end that still eludes us. Paradoxically, it seems as though humans have never been faced with so many problems of global proportions as we face today.

The deteriorating state of honeybee health around the world is just one of these problems. Colony Collapse Disorder (CCD), the term used to describe the unsettling disappearance of bee colonies, has been observed across the United States, Europe, China, Japan, and even North Africa (Kluser, et. al., 2010). At this point, some may be wondering why - why should we take the time to care about honeybees, when people worldwide are struggling to overcome famine and disease, changing climate and weather patterns, and social injustices of epic proportions? The answer to this skepticism is that bees play a critical role in many of the social, environmental, and economic crises that we now find ourselves up against. In fact, by asking the right questions, honeybees may even be able to provide us with valuable guidance as we strive to improve the state of human and ecological health around the globe.

Honeybees are well known for mainly two things: pollination and honey production. The *Apis meliffera* species is responsible for pollinating over 70 of 100 major crop species

worldwide, or about 60% of the global food supply (FAO, 2005). Annually, about 566,000 tons of honey enters the international market. The golden sweetener is important to cultures around the world, from the nomadic Ogiek tribe of Kenya, to the processed food industry of the United State. Honeybees play an enormous role in the global food system, contributing to the food security of billions through their pollination services and honey production. The significance of these two contributions alone certainly warrants and justifies our concern for honeybee health. But perhaps of even greater magnitude is the fact that honeybees function as a valuable biological indicator by revealing the overall state of environmental health (Ellis, 2005).

Miners used to lower a caged canary into the mines to indicate whether the conditions were safe for entry. If the canary died, the miners knew the environment was not safe. Like the canary test, the declining status of honeybee health is a larger reflection of the state of our environment, acting as a warning to humans to go no further. It is with this in mind that the decline of honeybee health carries implications that reach far beyond the immediate concerns of food security. For each incidence of CCD is analogous to pulling up a lifeless canary cage, signaling us to go no further. The decline of pollinators worldwide has shone a light on the devastating effects of pesticide use, air pollution, and habitat degradation (UNEP, 2010). These driving factors, coupled with management practices like the frequent transportation of hives across great distances, reuse of drawn comb, prophylactic drug treatment, and general colony manipulation, have lead experts to call into question many of the accepted practices of modern beekeepers (Ibid, 2010; Frazier, 2009).

Yet, it is precisely these inventions of modern man, innovations of the industrial age of development, that have enabled the honey industry to grow as it has. Today, large-scale beekeepers in the United States operate anywhere from 2,000 to 80,000 hives and account for

over 60% of honey production in the United States (Hoff & Willett, 1996). One such development, the Langstroth hive, was a critical invention in the industrial apiculture movement, enabling commercial beekeepers to produce more honey as well as transport colonies across country for the pollination of agricultural commodities. Twentieth century apiculture was characterized by the push to normalize and institutionalize the use of moveable-frame hive technology, resulting in the homogenization of apiculture knowledge and practice. Industrialized apiculture now dominates the landscape of beekeeping in the Western world, essentially transforming the honeybee from a wild source of sweetness into a mobile commodity.

In the development context, the opportunity exists to set a new course for beekeeping, instead of continuing down the path of industrialization that has lead us to the predicament we now face. For this reason, it is imperative to critically address the issues facing bee populations in developing nations, while they are not yet severe, and perhaps still preventable. Through the framework of international development history and theory, this thesis seeks to shine a light on these issues and concerns facing beekeepers in Kenya.

My main objective is to take a critical look at the current trajectory of beekeeping development in Kenya – where it stands, and where it is headed. My reasons for choosing Kenya as the focus of this exploratory case study are due in part to logistics, illustrative capacity, and also the urgent need for action. Of all Sub-Saharan African nations, Kenya receives the most aid from the United States government, at over $700 million in the year 2011 (Congressional Research Service, 2011). There is increasing attention from both bilateral and multilateral sources, including non-governmental organizations, research institutions, transnational corporations, and other interested parties, like China (The Economist, 2008). The culmination of these sources of development makes Kenya an excellent country for examining the influence and

impact of development work. Regarding beekeeping specifically, there is an abundance of literature and research documenting the advances of beekeeping in Kenya throughout the past half century. For these two reasons, Kenya provides the optimal conditions for an exploratory case study. In addition, recent discoveries concerning the presence of the potentially devastating *Varroa* mite in Kenyan bee colonies make this research even more imperative and relevant. Of course, the issues that arise in beekeeping development are certainly not isolated to the Kenyan context. Ultimately, it is my hope that the questions and suggestions posed at the culmination of my research can help in reframing beekeeping development beyond the borders of Kenya.

Methods:

The data and information used for this study was drawn from Kenyan government reports, United Nations and European Union documents, non-governmental organization reports and accounts, and academic and professional research publications. Many of these sources were gathered from the Bibliography of Commonwealth Apiculture, which is a comprehensive list of publications regarding beekeeping research and development in Kenya. While the bibliography provides an extensive compilation of various resources, it offers no further analysis of the information available. Using these sources as a guide, I chose the publications that pertained to the issues of development, improvement, or advancement of beekeeping in Kenya. Section 3 will be a literature review of these sources, where I will synthesize the various findings, specifically concerning those that pertain to the transfer of beekeeping technology and development in Kenya. I will also be looking at the literature that provides instruction and guidance for Kenyan beekeepers themselves. These resources will serve as concrete examples of the information and methods that are being endorsed most heavily by development projects.

There are several case studies I will highlight in Section Five, each of which provides valuable and detailed data. Case studies draw attention to the *hows* and *whys* of human behavior, and are especially useful in understanding "real-life phenomenon in depth" (Yin, 2009). The phenomenon I am interested in pertains to the development of beekeeping in Kenya and understanding *how* and *why* it has been pursued, and what the effects have been. It is important to remember that the nature of beekeeping development research in Kenya is limited in its scope. The case studies I will be using are not comprehensive, and provide merely a snapshot of a much larger image. In addition, much of the research was carried out decades ago, making the snapshot not only limited in scope, but also multidimensional over time. A common critique of the case study as a research method addresses this issue, and argues that the case study cannot be used to make broad generalizations (Ibid, 2009). While this is true in some regard, the analysis of *multiple* case studies reveals a more robust and multilayered perspective of a given phenomenon. It is with this intention that I will utilize the conclusions and findings of various case studies, and draw out common threads among them.

The following questions are significant in my literature review: What are the dominant trends in beekeeping development in Kenya, and the potential long-term impacts of this development work? How has development ideology molded the attitudes and goals of development work? To explore these questions I will draw upon the literature of classic economic development theory such as W. W Rostow's linear stages of development, the "Lewis Model" of economic development, and more general and recent theories of economic growth. I will also review literature that is critical of economic development theories, and therefore I must acknowledge the biased lens from which I am viewing the problems surrounding beekeeping and development. I am also biased, given my Western point of view, and lack of first hand

experience with Kenyan beekeepers. It is necessary to be transparent and forthright about the perspective from which I am approaching this topic, for in fact all research is ultimately a product of individual interpretations, assumptions, and particular ways of viewing the world. These limitations duly noted, my justification for approaching this topic with a critical eye on economics is influenced by the abundance of literature and discourse that fails to do so. Without discrediting the role that economics inevitably plays in any development scenario, I believe that there is a greater need for research, policy, and general discussion addressing the larger ecological implications of our current beekeeping development efforts.

SECTION 3: HISTORICAL AND CURRENT TRENDS IN BEEKEEPING AND DEVELOPMENT IN KENYA

Kenyans have been engaged in honey hunting and beekeeping for thousands of years, yet the activity only entered the radar of international development agencies in recent decades. Today beekeeping is recognized for its potential to expand into international markets, create diversified livelihoods, and alleviate rural poverty (Bradbear, 2002). The underlying motivation for improving beekeeping is to create economic opportunities through producing bee products of greater quantity and quality. Many development agencies look at Kenyan beekeepers and see an untapped market with great potential. As we will see, the dominant development ideology supporting apiculture research and development in Kenya is one of economic growth.

There are numerous ways in which to approach any development project. According to a synthesis report published by the organization Bees for Development, there are six main issues that must be addressed in Kenyan apiculture: (1) a lack of functioning markets, (2) limited access to extension services, training, and investment for business growth, (3) inadequate beekeeping skills and equipment, (4) poor production and processing technologies, (5) high transactional costs, and (6) a lack of organized producers. It seems that for successful development to occur, none of these areas should be ignored. However, the rhetoric and focus of development projects is imbalanced, giving more attention to one particular issue: beekeeping skills, equipment, and technologies.

The following section focuses on the foremost strategy of development in the Kenyan beekeeping sector: the transfer of modern technology. I begin by reviewing the historical roots of Western development in an international context, and the surrounding literature of economic growth as a development strategy. This background is useful for understanding how the Kenyan honey industry and bee population have been affected by current economic development efforts.

The literature review will illustrate the transfer of modern technology as a development method through examples of organizations that pursue improvement in Kenyan apiculture through innovation and technology diffusion. To finish, the successes and failures experienced in the beekeeping sector are reviewed, with a particular focus on the health of the Kenyan bee population.

Preceding this discussion is a brief background of three important hive technologies: (1) the traditional Kenyan log hive, (2) the Langstroth hive, and (3) the Kenyan Top Bar Hive. The information presented here will be useful in discussing technology transfer, and will also be helpful for future discussions of environmental and biological sustainability.

The Kenyan Log Hive: Fixed Comb

Throughout history, the most common type of hive in Kenya has been the horizontal log hive, which is typically constructed from standing or fallen trees (Seyffert, 1930). Today, the hollowed log hive is still considered to be the most traditional, and widely used method of beekeeping in Kenya. To construct a Kenyan log hive, the trunk of a fallen tree is cut to the desired length, and is then split in half, lengthwise, so that the inside can be carved out. The halves are put back together, and the resulting hollowed cylinder is then hoisted into the branches of a standing tree so as to attract swarms searching for a home, as well as protect the colony from predators like the honey badger. The ends of the hollowed log are plugged with grass or bark, and holes in the body of the hive are created to provide an entrance/exit for the bees (Include picture). For the large majority of Kenyan beekeepers, swarms searching for a new home were, and still are, their sole source of bees (Frazier, 2011).

The design of the hollowed log hive makes it a 'fixed-comb' hive, meaning that the honeybee attaches its comb directly to the interior of the log. The fixed comb nature of Kenyan hives makes them difficult for beekeepers to manipulate. Because of this, traditional beekeeping requires little maintenance or management. Many beekeepers contact with the hives is limited to setting the hive in the tree, and harvesting the honey. A survey of beekeeping practices among the Tugen people of Kenya revealed that 58% of beekeepers visit their hives once a year, while 21% visit their hives twice (Gichora, 2003). Some refer to this method of beekeeping as 'bee-having', since the bees are only maintained, rather than managed (Gentry, 1988).

In African cultures it is customary for men to do the harvesting, as it requires them to climb trees, an activity that is considered taboo for women to participate in. Harvesters will often complete their work under the cover of night when the colony is calmer, and they do so unclothed. Stripping themselves of any hanging fabric in which the bees may become trapped actually reduces their likelihoods of being stung (Gichora, 2003). Harvesting can occur in the tree itself, or the hive is sometimes lowered to the ground. Smoke is used to calm the bees, either by lighting a torch, or by building a fire at the base of the tree so that the smoke will rise to calm the hive. Comb that contains capped honey is cut away using a knife, or often bare hands. Skilled beekeepers are able to remove capped honey and leave the brood behind, however it is common for beekeepers to harvest the entire hive, including brood comb and uncapped honey (Crane, 1999). This practice results in almost certain death of the colony, or otherwise referred to as 'bee-killing' (Gentry, 1988). Honey containing comb is collected in harvesting containers, the most common being 4-liter plastic paint containers and leather bags that are made from local materials.

The traditional customs of processing honey begin with breaking honeycomb down into smaller pieces. These pieces are then crushed by hand, or with a wooden cooking stick into a large container, and the mixture is left, sometimes in the sun, to naturally separate. The remaining honey is then further processed by sieving it through a finely woven fabric, such as burlap or nylon (Gichora, 2003).

There are three main uses for honey in Kenya: food, medicine, and beer brewing. The use of honey for alimentation is crucial for many Kenyans, especially nomadic pastoralists, like the Ogiek peoples, who regularly engage in honey hunting to supplement their diet (Destifiano, 1990). Honey provides a rich source of energy, and is highly valued as a non-perishable and easily stored source of food. Honey is also used for its medicinal properties to treat open wounds and burns, and is taken to cure stomach problems like dysentery (Ntenga & Mugongo, 1991). Lastly, crude honey is used to brew beer. Local beer brewers actually prefer the unprocessed honey that still contains brood, pollen and bees, because it gives value and flavor in the brewing process (Gichora, 2003). This beer, called "kipketin", is an essential part of the marriage and initiation rituals and ceremonies in many indigenous cultures (Khayesi, 2001).

The traditional methods of beekeeping in Kenya are unique to the culture and lifestyle of the peoples. Specific techniques and degrees of knowledge vary from region to region. Most Kenyan beekeepers obtain training from elders in their village who pass the trade of keeping bees along through generations (Frazier, 2011). A recent study of the Tugen peoples showed that 52.5% of interviewed beekeepers received their training in beekeeping from a family member or someone from within their village (Gichora, 2003).

There are advantages and disadvantages to using traditional style log hives. The commonly cited advantages include, but are certainly not limited to (MacOsore, 2005; Frazier, 2011; Cheng'ole, 2008):

- Inexpensive to construct; low initial input (free)
- Made from local materials
- High beeswax production
- Requires little management or time investment
- Placement in tree protects hive from predators

However, development organizations often pay more attention to the disadvantages to log hives and cite the following drawbacks:

- Produce lower yields of honey (appx. 15 kg/hive/harvest)
- Quality of honey is poor; often includes brood and debris
- Harvesting is difficult as it requires beekeeper to climb the tree
- Bees abscond and swarm more often
- Poor harvesting technique can result in death of the colony

The Langstroth Hive: Moveable Frame

In 1851, Pennsylvanian beekeeper Lorenzo Langstroth revolutionized the beekeeping world with his discovery of 'bee space', the 3/8th inch gap that honeybees naturally leave between layers of comb. These findings paved the way for his invention of the movable frame hive, better known as the Langstroth hive (Horn, 2005) (provide picture in appendix). In his book *Langstroth's Hive and the Honeybee: The Classic Beekeepers Manual,* he professes that "a complete hive should give the Apiarian such perfect control of all the combs, that they may be easily taken out without cutting them, or enraging the bees" (Langstroth, 1878). It is with these goals in mind that Langstroth developed his hive.

Construction of the Langstroth hive requires an intimate knowledge of the exact dimensions needed to simulate a natural beehive, as well as the proper materials and tools for assembly. The hive consists of 'brood boxes' and 'supers', large open-ended boxes that are

stacked on top of one another. Each box holds ten four-sided frames containing a wax or plastic comb foundation. The frames are measured with bee space in mind, so as to mimic the natural environment of a honeybee hive. Once constructed, the beekeeper must be well trained in management techniques. Managing bee colonies in a movable frame Langstroth hive can be time intensive, and requires the attention and diligence of the beekeeper. Harvesting honey from the four-sided frames is extremely efficient and allows the beekeeper to compartmentalize and select specific combs that contain pure honey. The harvesting from such frames requires a centrifuge extractor if the wax comb is to be preserved.

Today, movable frame hives are valued by beekeepers for their ease of accessibility and manageability. The ability to remove frames makes it infinitely easier for beekeepers to inspect for disease and pests, to prevent colonies from swarming, and to increase honey production and harvesting efficiency. For these reasons, the moveable frame hive is a revolutionary technology that has been widely adopted around the globe, largely with the goal of honey production in mind. The advantages of Langstroth hives are as such (MacOsore, 2005):

- High quality honey, thus yielding greater economic returns
- Easily harvested honey
- Greater yields of honey (appx. 45-60 kg/hive/harvest)
- Easier to inspect for disease and pests
- Can prevent colony from swarming or absconding
- Women can participate

There are also disadvantages to the Langstroth hive within the Kenyan context. They are as follows:

- Require a large upfront financial investment
- Difficult to construct
- Require a comb foundation and honey extractor
- Can easily be stolen or attacked by predators
- Require high level of beekeeper training and management expertise

Frame hives have been widely adopted throughout North America, Europe, Australia, and even parts of South America and Asia. However, the Langstroth hive has not successfully been implemented in many Sub-Saharan African countries, due to the financial and technical reasons that were just listed.

The Kenyan Top Bar Hive: Moveable Comb

Keeping bees in top bar hives has been practiced for centuries, originally by the Ancient Greeks in woven basket hives. The Kenyan Top Bar Hive (KTBH) was invented in 1970 by G. F. Townsend and his team of Kenyan students at the Guelph University in Canada (Adjare, 1990). Their goal was to develop a hive that would serve as an intermediate approach to beekeeping for rural Kenyans living in poverty. The KTBH integrates elements of the traditional log hive, such as the shape and size, with the moveable comb feature of the Langstroth hive (Gentry, 1988). The trough-like hive body consists of a horizontal structure with outward sloping sides, mimicking the tapered shape of honeycomb that is found in nature. The top bars are cut to a width that provides the proper bee space between combs.

Unlike the Langstroth hive, the KTBH has a movable *comb*, which allows for beeswax comb formation that is not bound by a four-sided frame. Instead, the comb is only attached to the top bar, which is what enables beekeeper manipulation. Harvesting requires the removal of the wax comb, which is similar to the way that the fixed comb honey is gathered. However, because the combs can be manipulated, honey can be consolidated to one side of the hive, just as a beekeeper would consolidate honey in the top box of the Langstroth hive. This can be done using a queen excluder, which is a tool used in modern beekeeping that ensures the queen will not lay any eggs in sections of the comb that also contain honey.

It is recommended that the KTBH should be suspended at waist height by hanging the ends of the hive from a tree, or from poles. This transitional hive design seeks to combine the benefits of the Langstroth hive with those of the traditional hive, yielding a method that provides the following advantages (MacOsore, 2005; Gentry, 1988):

- Easier (than the Langstroth) to construct from scrap materials
- Possible to manage bees without killing them, or destroying the brood
- Beeswax production is high
- Quality of honey is better
- Easier to harvest honey
- Can better prevent absconding and swarming

However, even with a hive that seeks to combine the most optimal conditions for small-scale beekeepers, there are still disadvantages to the design:

- Easily invaded by carpenter bees and pests
- High initial cost for materials
- Specialized skills needed for construction and management

It must be noted that the advantages and disadvantages of each hive type are coming from a specific perspective. For the sake of simplicity, the advantages and disadvantages noted for each style of hive were categorized by how they are most commonly portrayed in the literature. However, depending on the interests of the beekeeper, an advantage of one hive may prove to be a disadvantage for another. This predicament will be further explored in the following sections. Based on the common portrayal of each hive design, it can be noted that the Langstroth hive and KTBH are both praised for their ability to produce greater quantities of higher quality honey. These advantages form the basis behind the movement to develop and modernize methods and technologies of beekeeping in Kenya, based on the belief that with greater honey production stems the potential for new markets and economic growth. With that point, I now turn the discussion over to address the history and current state of beekeeping development in Kenya, preceded by a contextual orientation of development history from a broader perspective.

The Economic Development Paradigm

In order to understand the history of beekeeping development, it is important to recognize the larger context of development from a more general perspective. How did the idea of development as we now know it come to be? What and who are the underlying ideologies and motivators that have fueled the rise of global development? Surely the desire for progress is ubiquitous throughout the history of human kind. However, there is a distinct difference between the desire to progress one's own society and the desire to incite progress in the lives of others. When did this shift in development focus occur, and why? Exploring these questions will provide an important context for understanding the history and current state of beekeeping development in Kenya.

The development of 'the other' holds deep roots in the post-World War II initiation of the Marshall Plan, which gave birth to the World Bank and the International Monetary Fund (IMF), as well as the Truman Doctrine, what would soon become an influential guide to United States foreign service and policy for decades to come (McMichael, 2008). Truman's inaugural speech in 1949 ignited the development spark, raising the awareness and concern for people living in poverty around the world. The proposed solution stemmed perhaps from empathy and a moral obligation to humankind, combined with a strong sense of American hubris. Truman advocated for "making the benefits of our scientific advances and industrial progress available for the improvement and growth of underdeveloped areas". These underdeveloped areas were characterized by food insecurity, disease, and "stagnant and primitive" economies (Truman, 1949). It is with this attitude that the notion of development progressed worldwide, held up by the financial support and policy advice from international financial institutions like the World

Bank and the IMF. Development was officially institutionalized by the United States in 1961 when President Kennedy signed the Foreign Assistance Act, establishing the United States Agency for International Development (USAID, 2011). The act of providing assistance to underdeveloped nations was also made available to U.S. citizens in the same year under the Peace Corps Volunteer Program (Peace Corps, 2011). European nations followed similar trajectories in establishing international aid organizations. The United Nations Development Programme (UNDP) originated in 1966 as a special fund to support the growth of infrastructure and industrialization. The United Kingdom Ministry of Overseas Development was established in 1964, and is now referred to as the Department for International Development. Both advocated for lifting poor nations out of poverty through economic development and technological assistance (UNICEF, 1996; Murphy, 2006; DFID, 2011).

Also guiding the new 'development project' of the 20th century were the development theories of economic experts such as W.W. Rostow and W. A. Lewis. Rostow was most famous for his 'stages of growth' model of development, which outlines a linear progression of various economic stages that a nation should follow in order to achieve development. The stages range from 'traditional society', representing the subsistence and agrarian lifestyle, to 'high mass consumption', a state characterized by consumer demand and a flourishing industrial economy. Rostow, along with other theorists of his era, portrayed development as a linear process of modernization and industrialization. Lewis, a Nobel Award winner in economics, contended that the process of transforming a subsistence society into a capitalist economy is a cyclical, self-reinforcing process, ultimately leading to economic growth and development. Essentially, his postulation called for a shift in economic landscape, from one comprised of informal employment, to one of formal-sector labor, a defining element of the modernized nation (Lewis,

1955). Lewis' work, especially his paper *Economic Development with Unlimited Supplies of Labour*, published in 1954, has been referred to as one of the most influential factors in the academic institutionalization of development economics (Kirkpatrick & Barrientos, 2004).

A uniting element of twentieth century development ideology lies in the shared assumptions that they are dependent upon. The chain of the main assumptions that comprise economic growth theory are as such: (1) that economic growth will bring about a higher standard of living, (2) economic growth can be brought about through the application of modern science and transfer of technology, (3) the scientific approaches and technology produced by academically trained experts are superior forms of knowledge.

To briefly delve deeper into these assumptions, one must look to the epistemology of these influential leaders of development. How did the economic theorists like Rostow and world leaders like Truman come to understand the world around them? Under what structures, limitations, and sources of knowledge did these assumptions come to form? The simple answer to these questions lies in positivist epistemology, the predominant worldview of at least the Western world since the Age of Enlightenment (Murowski, 2005). Positivist thinking describes a way of understanding our world that relies upon scientifically produced knowledge. Ultimately, our positivist epistemology becomes the driving force behind our scientific methodology, research, and knowledge produced. This point is brought up not with the intent to critique the scientific point of view, but rather to acknowledge the philosophical roots of economic growth and development theories.

Perhaps just as relevant as understanding the theoretical and philosophical origin of development theory is an awareness of the discourse commonly used in development dialogue. The discourse of international development is dominated by the language of economics. Phrases

like ‘diversified livelihoods’ and ‘income-generating activities’ have become popular buzz-words among development agencies, both signifying advances in monetarily measured change. For decades the dominant statistic used to measure poverty and development was Gross Domestic Product (GDP) – the market value of all goods and services produced within a country (source). Critics of GDP as a measure of development argued that the value is superficial and ignores the distribution of national income across the population and fails to address the underlying issues of poverty (Costanza, et.al., 2009; Dasgupta, 2001; Sen, 2000). Essentially, experts began to call into question the connection between a nation’s economic activity and the level of wellbeing the population experiences. The critique gave rise to alternative, more comprehensive methods of indicating poverty like the Human Development Index (HDI), which gives weight to factors such as years of education, life expectancy, and income *per capita* (UNDP, 2011). In addition, the United Nations Millennium Development Goals name eight aspects of the human condition that require attention from the world, addressing specific issues like maternal health, primary education, infant mortality, AIDS and malaria, and environmental sustainability (United Nations, 2000). Today, it seems standard fair for government and non-profit development initiatives to engage in dialogue that shows concern for these social and ecological indicators. And yet, while our discourse has shifted slightly, our approach has not quite caught up. The fact remains that ecological and social problems are still being framed through an economic lens (McMichael, 2008).

The most pervasive worldview in development work is one of *economism* (Ibid, 2008). Characterized by figures of imports and exports, employment status, and income per-day, this perspective of global development seeks to address social and ecological issues through economic strategies. In other words, economic growth becomes the means to an end – the end

being a higher quality of human living conditions. Yet, as is often the case in development projects, the focus is on the means; on economic progress. Even in the case of beekeeping, research, extension, and government reports tend to define success by an increase in income, not necessarily an increase in wellbeing. This point begs the question: How can beekeeping bring about economic development and increased rural income? The following subsection explores this question, outlining historical and current trends of apiculture development in Kenya.

Literature Review of Beekeeping Development in Kenya

The movement to improve Kenyan apiculture began in 1967 through an Oxfam grant that funded their very first beekeeping development project. In 1970 the Kenyan government, along with financial and technical aid from the Canadian government, established a new Apiculture Section (The National Beekeeping Station) within the Kenyan Ministry of Agriculture. The new branch would pursue the development of Kenyan beekeeping through extension services, research development, and the professional training of Kenyan beekeepers (Kigatiira, 1976). It is at this point in time that Western beekeeping technology and knowledge was first introduced to Kenyans.

Technology transfer has been the keystone piece of international development work for decades (Radošević, 1999). Especially in this globalized world, the economic growth of all countries, to a certain degree, depends on the knowledge, resources, and technology that are shared across borders. This has forever been the essence of progress, improving the quality of life, and in the case of international development, assisting others in this pursuit. This is no exception in the case of Kenyan beekeeping. Current trends in development remain focused on the improvement of hive technology and beekeeper training as the first and foremost approach.

Recommendations from government agencies and extension personnel, non-profit development groups from the West, and academic researchers all cry out in unison for the need to bring Kenyan beekeeping out of the past, and into the future of modern moveable-comb hives (Gichora, 2003; Nyakundi, 2007; UNDP-Keyna, 2008; Ntenga, 1991; FAO, 1990; Mann, 1976).

Aside from academic and government recommendations, many private companies have joined the effort to modernize husbandry practices in Kenya. The for-profit model of apiculture development claims to provide a stable market for honey, under the condition that their producers use Langstroth hive technology to ensure a clean product for international sale. Honey Care Africa (HCA) is one such company, whose for-profit business model includes a required training of Langstroth management for all beekeeping partners. Their assertion is that modern hive technology is the best option for quality control, and also results in higher yields of honey. The organization also derives income from their sale of equipment to beekeepers, a necessary investment if they want to engage in business with HCA (Honey Care Africa, 2005). A similar business model is exercised by African Beekeepers Limited (ABL), a private company engaged in the promotion and supply of modern beekeeping technologies that will foster the emergence of a commercialized beekeeping industry (African Beekeepers Limited, 2010). The venture has supplied Langstroth hives and processing technology to twelve regions of Kenya, also profiting from the sale of the equipment itself. While they do not report the total number of hives under their operation, they do account for over 500 Langstroth hives that have been introduced into the Kenyan Maasai Maru National Reserve alone (Ibid, 2010).

The Kenyan government is another avid proponent of introducing modern hive technology to rural farmers. Through the Ministry of Agriculture and Rural Development, extension agents aid rural beekeepers with intensive training, support, and research in order to

improve hives and equipment (UNDP – Kenya, 2008). In addition, the Kenyan Agricultural Research Institute (KARI) has published resources for farmers, one of which is entitled *Make Money from Bees*. The short booklet advocates for the use of intermediate (KTBH) or modern hive technology (MacOsore, 2005). A review of the field guides and training manuals for Kenyan beekeepers shows a strong bias towards modernized technology. A bilingual booklet published by the Kenyan Animal Health and Industry Training Institute explains in English and Swahili that the reason for the undeveloped honey market in Kenya is the "lack of skill and attention on the part of the producer". It goes on to assert that the goal of the booklet is to teach improved methods of beekeeping and show that beekeeping is more profitable with better equipment (Mann, 1976). Another field guide published by the United States Peace Corps continues this trend of technological advancement in its promotion of the KTBH. This guide to beekeeping development also portrays traditional methods of beekeeping as 'bee-killing' (Gentry, 1982). In summary, this review of academic, private, and government literature shows that the dominant trend in beekeeping development is the endorsement of modern hive technology, be it the Langstroth hive or the KTBH. However, the adoption and diffusion of beekeeping equipment is certainly not pursued without a significant degree of resistance and failure.

The Challenges of Technology Diffusion and Adoption

The question of adopting new technology is one that most individuals will face in their lifetime. To decide whether or not we should adopt a new practice or piece of equipment depends on the ability to make an informed decision about how the technology will affect our wellbeing (Aregay, 1980). There are certain conditions that must be present for an individual to

adopt new innovations. They are: the availability of sufficient information, the existence of a favorable attitude towards the innovation, the financial capital with which to purchase the innovation, and the actual availability of the technology itself (Yapa & Mayfeld, 1978). In addition, successful adoption means that the technology is in continued use over a long period of time.

For rural Kenyan farmers who are faced with the decision to adopt new hive technology, the logistics of alternative hive adoption in Kenya are complicated. It requires the initial training of new beekeeping methods, sufficient financial capital, extension services to provide support for prolonged adoption, and adequate time to devote to the new enterprise (National Agricultural Research Foundation, 2004). The provision of adequate extension is a common problem that accompanies the transfer of technology. One of the key factors contributing to poor technology adoption is often due to differing perspectives of extensionists and beekeepers (Bradbear, 2002). A study of rural Mexican beekeepers faced with the decision to adopt a top bar hive revealed a unanimous rejection of the hive based upon cultural, financial, and environmental reasons that the government extension agents were unaware of (Arce & Long, 1987).

Similarly, a recent study of the Baringo District in Kenya sought to determine the adoption rate of KTBH after nearly fifty years of government involvement in beekeeping improvements. The study found that retention rates of KTBH use were extremely low, and that many beekeepers were applying traditional beekeeping methods while attempting to use the KTBH (Gichora, 2003). A similar situation has been observed with Langstroth hives, which have been found not only unoccupied by bees but in use for non-bee related purposes (Susan Wren, Bio Enterprise Development Programme). This is a common trend in the field of development, especially with regard to innovation diffusion and adoption, and has been observed with malaria

nets serving alternative uses as both fishing nets and bridal veils. Research and extension agents often attribute poor innovation diffusion to a lack of knowledge, resulting in misperceptions of the innovation itself (Ozowa, 1997). In other words, the problem lies not in the hive, but in the beekeeper.

Unfortunately, this short-sighted view of technology adoption is dependent upon unsubstantiated claims. As the lack of literature proves, we do not fully understand the reasons why Kenyan beekeepers are not adopting modern hives and equipment. Perhaps it is the imbalanced approach to development that has lead to an abundance of technology, but offers little in the way of training, local support networks, and market development. Or perhaps the supply chain for honey is dysfunctional, and farmers would benefit more from increased means of communication and transportation. In addition to the technical obstacles that impede expanding honey markets in Kenya there exists a number of complex social and cultural factors that confound development projects. Among these intangible, yet very important factors includes the stigma associated with female beekeepers, the traditional use of honey for brewing and medicinal purposes, and the strong cultural identity that is often linked to traditional log hive beekeeping. Efforts to expand the honey production capacity in Kenya have only recently begun to take notice of these alternative barriers facing beekeepers.

There is also a negligible amount of data showing the success of new technology in the overall improvement of rural livelihoods. In fact, the UK-based organization Bees for Development asserts that the modern hive design "had little bearing on whether beekeeping ultimately provides worthwhile livelihood"(Bradbear, 2009). There are many lingering questions concerning the benefits of modern hive adoption, yet efforts to promote modern technology in Kenya remain unabated. After a fifty-year history of development focused on the introduction

and use of modern hives, have these efforts been worthwhile? Is there sufficient data available to draw conclusions about modern hive superiority? Or are we moving forward in blind faith that modern hive technology will ultimately improve Kenyan beekeeping and lead to a higher standard of living? These questions remain unanswered, and leave room for skepticism and the need for a critical assessment of the economic impact of modern beekeeping practices in Kenya.

However, I must argue that the most important aspect of beekeeping development is being ignored altogether. In the midst of our efforts to increase income, expand markets, and increase the quality of human life, we have entirely forgotten the very reason this development work is possible at all: the health of the bees themselves. Bringing us back to the larger issue at hand, the impact of modern technology on Kenyan honeybee health has been left neglectfully unexplored until very recently.

Consequences for the Honeybee

As the developed and developing worlds delve further into a system that embraces efficiency and economic growth, we also are experiencing heightened ecological and environmental deterioration. The honeybee has certainly not escaped these circumstances unscathed. Pollinator decline is becoming a worldwide concern, with honeybees receiving extra attention due to the unsettling and mysterious nature of their disappearances, otherwise known as Colony Collapse Disorder (CCD) (McCarthy, 2011). While the exact cause of this massive decline cannot be pinpointed, most theories attribute it to the coalescence of factors including the presence of Varroa mites, pathogens such as *Nosema ceranae*, and the use of agricultural pesticides (vanEngelsdorp et. al., 2009). The parasitic Varroa mite is considered one of the formidable threats to honeybees because it not only weakens the honeybee but also transmits

viruses like deformed wing virus (DWV) that further impair honeybee health (Yang & Cox-Foster, 2005). The one thing that seems to be clear is that CCD is being caused by patterns of human behavior driven by economic goals. Some argue that in order to reverse the devastation imposed upon the honeybee population we must identify the destructive practices and eliminate, or ameliorate them. In the United States, extensive resources and research are being devoted to conclusively determining what exactly these practices are. But until then, we will continue to spray pesticides on our fields, treat bee colonies with prophylactic drugs and antibiotics, and truck thousands of bee colonies from coast to coast for pollination, all for the sake of our economic stability and agricultural production.

If, in the future, we manage to scientifically prove that our practices of beekeeping are contributing to their demise, it will be too late to change history. However, in other parts of the world like Kenya, it is not too late to prevent or minimize honey bee/pollinator decline. There are currently no reported incidences of CCD in Sub-Saharan Africa, yet the possible contributing factors have already begun creeping into the Kenyan bee population.

In a collaboration between the Kenyan branch of the International Center for Insect Physiology and Ecology (*icipe*) and Penn State's Center for Chemical Ecology, researchers made a surprising discovery in Kenyan beehives: the pervasive presence of Varroa mites throughout the country. A year later, in 2010, the research team returned to Kenya with a new objective, to analyze the effects of Varroa mites on Kenyan bee colonies. An assessment of fifteen different apiaries conclusively showed that the health of *Apis mellifera* in Kenya has declined, likely due in part to the presence of Varroa mites. This conclusion was based upon observations of lower rates of colonization of hives, smaller colony sizes, and decreased honey production (Frazier, et.al. 2009).

The discovery of *Varroa destructor* in Kenyan bee populations carries serious implications for the beekeeping development sector, and the ecosystems that depend on honey bee pollination. The correlation of increased pest and disease susceptibility and modern hive technology must not be overlooked. It is important to recognize that this correlation of events does not necessarily imply a direct causation – it would be impossible to conclude that the rise of modern hive technology triggered Varroa mite infestations in Kenya. Nor should it be implied that the technology itself is the cause of Varroa infestation, but rather the management practices that a movable-comb hive design dictates. In fact, the negative relationship between modern management practices and honeybee health has already been recognized by governments and extension agents worldwide (Australian DAFF, 2012; MAAREC, 2005). Some of the commonly cited practices include: migratory beekeeping, shipment of queens and package bees, and normal apiary manipulations. This possible link to worldwide honeybee decline warrants further analysis by researchers, and caution moving forward in the development sector.

So what is at stake in this relationship between honeybees and humans? Those who approach the world through an economic lens would say the potential for honey production and agricultural productivity stands to thrive, or suffer, the most. I must argue however, that the greatest threat this relationship poses is to the health of the *Apis mellifera,* and the ecosystems that depend on their pollination services. As with any livelihood strategy that relies upon the health of another organism, whether plant or animal, beekeeping can only be productive for humans if it is sustainable for the bees as well. The mutual interdependency between honeybees and humans reminds us that actions made in the pursuit of societal advancement do not come without consequences for the honeybee, and the ecosystems that cradle this relationship. Our interactions with each other regarding honeybee management send out ripples of reaction and

change among the human population as well as the honeybee population. It is our hope, and the hope of development, that this change is for the better. However, we can no longer avoid the fact that a negative consequence for honeybees could mean anything different for ourselves. Ultimately humans and honeybees occupy the same biosphere, rely upon the same sun as a source of energy, feed upon the same sugary products of photosynthesis, and hydrate from the same pools of freshwater. Our worlds are one in the same, which inextricably links our interests and futures. Thus, it is imperative to find an approach to beekeeping development that weighs the environmental and biological implications equally to those for humans. Could it be, that what is good for the honeybee is also good for the environment, and even for humans? In the following section I will present the case for an approach to beekeeping development that considers this question through the lens of environmental sustainability.

SECTION 4: A CASE FOR ENVIRONMENTALLY SUSTAINABLE BEEKEEPING

Sustainability Defined

In recent decades a counter movement of *sustainability* has arisen in reaction to the shortsighted pursuits of industrialized economic development. In 1987, the Brundtland Commission of the United Nations defined sustainable development as that which "meets the needs of current generations without compromising the ability of future generations to meet their own needs" (WCED, 1987). The theory of sustainability seeks to strike a balance between the promotion of environmental, social, and economic progress, while recognizing that no one 'pillar' stands in isolation. Perhaps most importantly, the concept elicits an awareness of the interconnected and interdependent nature of the world we live in. It reminds us that our decisions in the economic realm of development will inevitably have a bearing on the environment as well. Therefore, based on the Brundtland definition, sustainable beekeeping practices should be concerned with future generations of honeybees, as well as the future of mankind.

In light of this new development trend, beekeeping initiatives have been quick to adopt the Kenyan Top Bar Hive (KTBH) as the ultimate economically and socially sustainable solution for beekeepers in Sub-Saharan Africa. The KTBH is hailed as an economically viable solution for increasing honey production because it can be constructed from locally available materials, and is thus considerably less expensive, a key component of the hive's 'sustainable' status. And while the KTBH does enable honeybees to build their own comb, there have been various observations that suggest the KTBH is ultimately an unsuitable environment for tropical bees. One of the most common issues with top bar hives in Kenya is the effect of overheating (Gichora, 2003; King, 2011). The insulation provided by a hive is critical to the maintenance of its inside temperature, and depending on the materials used to construct the KTBH, it is often

under-insulated, which leads to overheating of the hive. In this light, the biological suitability and sustainability of the top bar design must be called into question.

This discussion of sustainability also requires that a distinction between the terms 'sustainable development', and 'sustainable beekeeping'. Are these two concepts mutually inclusive? In other words, does sustainable development necessarily result in a sustainable future for the bee population as well? And is sustainable beekeeping capable of fostering sustainable development? The answers to these questions remain unclear, and stand as a reminder of the ambiguity that often surrounds development work. Whether intended or not, the effect of this ambiguity is that economic development is pursued under the guise of sustainability. While it is true that sustainable work must be financially lucrative in the long run, the environmental and social impacts should not be overlooked. This imbalanced approach to sustainability is not entirely uncommon, partly due to the fact that sustainability leaves ample room for varying interpretations. Sustainable development projects are often embedded with underlying interests and motivations, causing the scales to shift in a particular direction, be it environmental, social, or economic. In addition, context is a critical element of the development process, which makes it impossible to create any overarching and specific guidelines for sustainability. The local context must always be taken into consideration when deciding what is the most sustainable, and appropriate technology (Bärlund, 2005; Heaf, 2011).

In an effort to disambiguate sustainability in the context of apiculture development, the non-governmental organization Bees for Development gathered to establish a clear and universal framework for sustainable beekeeping. The international group of beekeeping experts named three dimensions of apiculture that are crucial in the context of sustainability: (1) environment, (2) genetics and population, and (3) husbandry (Lowore & Bradbear, 2009). Within each

category the group identified behaviors that constituted sustainable, non-sustainable, and wild beekeeping. They also stress the importance of understanding sustainability from a wider perspective of overall population health, rather than at the micro-scale of individual colony or apiary. The difference, they assert, matters in determining *for whom* the development is sustainable. For example, the traditional methods of log hive harvesting in Kenya often result in colony death, a practice that most beekeepers would deem unproductive and unsustainable – for the beekeeper that is. BfD points out that husbandry practices that are often referred to as 'bee killing' actually allow for new colonies to inhabit the space and construct new clean comb for themselves. The turnover of colonies contributes to the prevention and suppression of disease and pests, making the practice sustainable for the long-term health of bee populations. The lesson to be learned from this example is that sustainability is not just a matter of *how*, but also a matter of *for whom?*

The issue of sustainability raises many questions for those involved in the beekeeping industry and development. No matter how drastically beekeeping development improves the lives of rural Kenyans, what good will it serve future generations if these efforts simultaneously threaten the lives of the bees? Do current beekeeping development strategies consider the health of future honeybee populations? How often do we hear about the advantages and disadvantages of hive models *for the bees?* What would beekeeping development look like if we began with these questions in mind? To begin answering these questions, we must first look to the honeybee itself.

A crucial component of sustainable development is the ability to work with the natural rhythms and cycles of the earth. Thus, sustainable beekeeping requires a profound understanding of, and respect for honeybee biology and behavior. Methods of beekeeping should seek to

embrace the natural behavior of bees as an inherently sustainable system that has evolved over millions of years. We must work under the assumption that the behavior of honeybees is not only key to their success as a species, but to ours as well. The predominant race of honeybee in Kenya, *Apis mellifera scutellata,* is distinctly different from the European honeybee in various ways. African honeybees (1) engage in seasonal migration, and abscond more frequently, (2) tend to have a smaller sized colony, and (3) practice more efficient hygiene. These differences, while noted and recognized by proponents of modern technology, are generally viewed as banes to beekeepers, rather than boons to the health and sustainability of bees. The following section will highlight these three unique attributes of the African honeybee and their value in pursuing environmentally sustainable apiculture development.

African Honeybees: Sustainable Instincts and Behaviors

(1): Seasonal Absconding, and Migration: Perhaps the most inherent difference between temperate (European) bees and tropical (African) bees is the higher incidence of absconding behavior in tropically evolved bees, like those of Kenya (Winston, 1991). The frequent absconding behavior of African bees allows them to evade pest infestations and maintain strong colonies (Frazier, et. al., 2009). Absconding refers to the event in which an entire colony deserts their old hive in search of a new home. This behavior differs from swarming, a reproductive behavior in which the colony schisms itself into two or more factions. Reasons for absconding can be generally divided into two categories: colony disruption and lack of resources (Ibid, 1991). The latter cause of absconding, sometimes referred to as 'seasonal absconding' is a direct result of the resource limited tropical environment honeybees have faced for millions of years. Incidentally this survival tactic functions in more than one way – frequent absconding also aids

colonies in avoiding potential build-up of devastating diseases, such as *American foulbrood*. The ability to leave an infected hive and relocate in a new tree hollow enables the colony to escape total colony collapse. From a sustainability perspective, frequent absconding is an evolutionary mechanism that ensures colony health and productivity.

When a colony makes the decision to abscond, it is a poor reflection on the surrounding environment rather than a poor reflection of the colony itself. In fact, an observational study of four tropical bee colonies in Botswana revealed the prerequisites of seasonal absconding, all of which indicate colony strength. Of the four hives under observation, two made the decision to migrate. These two hives showed increases in population size, amplified brood production with low levels of brood mortality, high levels of food storage, and increasing mass. Of the two hives that did not migrate, the opposite of each trend was exhibited, and one colony eventually died of starvation. The takeaway from this study is that a honeybee colony will only be capable of relocating if it exhibits strong numbers of bees, adequate food production and storage, and the establishment of a new hive site (Schneider & McNally, 1992). Therefore, a high rate of seasonal absconding is a direct reflection upon the strength and resilience of the overall honeybee population.

However, in the eyes of a honey producing beekeeper this tendency to uproot is a limiting factor in honey production. Rather than being viewed as an asset to the bee, absconding is considered a problem for the beekeeper that needs to be "overcome" with innovative technology (Wilson, 1991). Modern movable comb (KTBH) and movable frame (Langstroth) hives can be strategically manipulated to prevent colonies from their natural instincts to swarm and abscond. In fact, this is one of the most commonly cited *advantages* to keeping bees in a modern hive. Yet as a result, modern beekeeping has come to depend on a variety of chemical inputs including

antibiotics like oxytetracycline, pesticides such as coumaphos and fluvalinate, and bio-pesticides and essential oils such as formic acid and thymol to control disease and parasites. As previously discussed, pesticides are also implicated as contributing to CCD in the West. In contrast, traditional log hive beekeeping is largely a management-free practice, which allows for and actually depends on swarming and absconding behavior. There is reason to believe that this hands-off approach to beekeeping is an important element in African bee resistance to pests and disease (Frazier, et.al., 2009).

(2) Colony size: Another important distinction to be made between temperate and tropical bees is their average colony size, which in turn influences nesting preferences and honey production capacity. On average, African honeybees prefer nesting cavities that are 1-5 gallons in volume, whereas the European species prefers a volume of at least 10 gallons (IFAS Extension, year?). This is partly due to the fact they need less space for the colony itself, but also they require less room for honey storage. Europeans colonies are larger in bee numbers and need a sizeable space for building up winter honey stores. The implications of this difference for beekeeping development are twofold. First, modern hive designs are not constructed with nesting preferences of African bees in mind, and thus lead to lower rates of colonization (Gichora, 2003; Mulindo, et al., n.d.). Second, the development of a beekeeping industry in Kenya depends on increasing production of honey from a species of bee that does not naturally store large quantities of honey. In fact, African bees are evolved to migrate in search of forage and water, rather than stock-pile large reserves of honey in preparation for periods of dearth. The employment of large-size hives and the expectation that African bees will produce copious amounts of honey, end up working against the evolutionary adaptations that are inherent to African races of *Apis mellifera.*

(3) Hive cleanliness: As previously discussed, *Varroa mites* were not known to exist in Kenyan hives until very recently (Frazier, et.al. 2009). Yet perhaps the most interesting observation of the study was not the surprising discovery of Varroa mites, but the relatively unaffected health status of infected hives. Why were these African honeybees able to remain resilient in the face of the Varroa mite? The answer may lie, at least in part, in their ability to keep tidy. The evolutionary biology of African bees has resulted in a species exhibiting superior hygienic practices, and thus a more resilient bee population (Shimanuki, Knox, and De Jong 1991). The natural instinct of a colony with Varroa infested brood is to remove the diseased and dead brood from the hive. The more efficient this process is, the less likely a colony is to fall prey to the diseases and parasites. Stated more plainly, African bees are most likely better than European bees at keeping a pest and disease free hive, ultimately resulting in a healthier colony.

In summary, the concept of sustainable beekeeping is more complicated that it may initially appear. While the term sustainability was developed by humans to guide human activities, the very definition of sustainability requires the consideration of all affected parties. In the case of bee management, this includes the perspective of the bees themselves. If certain behaviors are beneficial to the bees, it is in our best interest to preserve these instincts rather than suppress them.

In Tammy Horn's *Bees in America: How the Honeybee Shaped A Nation*, she compares honey hunting, a less controlled method of honey acquisition, to the modern movable frame hive system. She describes honey hunting as a method that creates "*independence and environmental sustainability*". The latter, beekeeping, is described as a manifestation of "*scientific progress and efficiency*" (Horn, 2005). Incidentally, this analogy perfectly applies to beekeeping, as well as more broad theories of development. As we have already seen, most efforts to work with

beekeepers in Kenya are focused on realizing the economic growth potential of the activity, mainly through the introduction of a modern, moveable-frame hive. Following Horns line of thinking, what would a model of environmentally sustainable beekeeping development look like? Perhaps to answer this question, it would be wise to take a closer look at the traditional methods of beekeeping in Kenya.

SECTION 5: A CASE FOR INDIGENOUS KNOWLEDGE

Indigenous knowledge (IK) refers to the collected body of unique knowledge and skills that a community or culture develops over time. It is dynamic in nature and is inherently connected to the local environment from which it originates. Indigenous knowledge encompasses the practices, beliefs, technology, and ways of living particular to a given community (Semali & Kincheloe, 1999; Fisher, 2000). As defined by Lindblom and Cohen (1979), IK "does not owe its origin, testing, degree of verification, truth, status, or currency to distinctive professional techniques, but rather to common sense, casual empiricism, or thoughtful speculation and analysis". In this section the following terms will be used interchangeably to refer to indigenous knowledge: traditional knowledge (TK), and more specifically, indigenous beekeeping knowledge (IBK).

Indigenous knowledge stands to play a crucial role in creating sustainable approaches to beekeeping in Kenya. As the previous section pointed out, truly sustainable development fulfills the long-term needs of bees by responding to their natural behaviors and instincts. This view of sustainability reflects the very nature of indigenous knowledge, which is a result of human interactions and adaptations to their local environment. In essence, IK is embedded in and shaped by the natural rhythms and cycles of the environment. The potential that this information holds in the future of beekeeping must not be underestimated. Since the Western world has fully adopted modern systems of bee management, our understanding of indigenous relationships to bees is limited to historical records. However, the unique opportunity to record, learn from, and preserve the traditional methods of Sub-Saharan African beekeeping still exists. Unfortunately, indigenous knowledge is not yet widely recognized by experts engaged in international development.

International development work relies heavily upon science-based knowledge, which creates little space for the experience, wisdom, and needs of local peoples. Science seeks to separate knowledge from the context in which it is produced, it's legitimacy validated by its epistemological distinctiveness from 'ordinary', traditional knowledge (Fischer, 2000). At the International Conference on Conservation of Biodiversity in Africa it was noted that the expert-driven fields of social science have played a major role in "maligning" and thus devaluing IK throughout the 20th century (Warren, 1992). In fact, traditional knowledge that was once considered 'backwards' by many researchers is now recognized as holding answers to many of our technology-induced crises. A clear example of this can be seen in the development history of agricultural practices. The Green Revolution was characterized by the promulgation of technology such as genetically engineered seeds, petroleum consuming equipment, and chemical pesticides and herbicides. Over forty years later, scientists are beginning to realize the devastating environmental consequences of these very innovations – loss of biodiversity, greenhouse gas emissions, and polluted soil, water, animal, and human life. Now, trends in international agriculture development are making a turn back towards the very same traditionally organic farming practices that were condemned as inefficient not long ago.

Today this very same scenario can be seen playing out among Kenyan beekeepers and development agencies. Nicola Bradbear, co-founder of Bees for Development, explains the general approach to international beekeeping development as such: "There are so many people who see beekeeping being practiced in a way that to them seems 'primitive' and set about introducing the beekeeping that they know from home, thinking that it will mean great improvement… with no thoughts that there was anything good about the bees and the beekeeping practices that were there already."(McNeil, 2011). Section Three discussed the

unyielding efforts to disseminate and promote modern technology and management practices throughout Kenya. It also brought attention to the fact that these very technologies and management practices could ultimately be the very reason the European honeybee population is experiencing such devastation (Frazier, 2009; Bradbear, 2009). Despite this, research continues to focus on how to make new technologies and economic models of growth successful in traditional Kenyan culture. A shift in paradigm is necessary to direct beekeeping development in a way that would support biologically sustainable development, guided by the knowledge of indigenous peoples.

The first step in this paradigm shift requires the documentation of IBK. The National Research Council has warned development agencies that the documentation and compilation of IK should be a "research priority of the highest order… indigenous knowledge is being lost at an unprecedented rate, and its preservation, preferably in data base form, must take place as quickly as possible" (National Research Council 1992: 45). Fortunately, decades of western involvement in Kenyan beekeeping have resulted in copious documentation of IBK. There are detailed records of IBK concerning hive construction, honey harvesting and use, local forage potential, honeybee biology, and pest control. Local beekeepers possess an enormous amount of knowledge that can be utilized in sustainable development. Knowledge about swarming behavior, migration patterns, forage preferences, optimal harvesting conditions, market potential and honey demand, and the availability of local materials for making log hives are just a few examples of useful information that can help inform development in apiculture. However, despite the wealth of indigenous knowledge, it continues to be neglected and undervalued by research and development initiatives.

Thus, the second step to creating a shift in paradigm is encouraging the *utilization* of IBK. By utilization, I am referring to the integration of traditional knowledge in the development process. Researchers continue to ask the same question: 'How can we change this practice to make it better?' Yet the most important question *not* being asked by experts is 'What can *we* learn from the knowledge of those who have been successfully keeping bees under the unique environmental conditions of East Africa and Kenya?' The following case studies will provide a look at development projects that are beginning to ask this very question by embracing and integrating the sophistication of IK to create environmentally, socially, and economically sustainable development projects.

Case Studies

1.) The "Best Practices" Approach

The 'Best Practices' approach to development views indigenous knowledge as the key to creating sustainable projects for improving the livelihoods of rural communities. Working in a partnership with UNESCO, the Netherlands Organization for International Cooperation in Higher Education (Nuffic) joined the growing movement to document, compile, and protect IK from around the world. Their justification for doing so was based on the observation that "research projects have shown that there are no general technical western solutions for solving specific local problems… these interventions have lacked both the will and the instruments to allow people to use their own knowledge" (Boven & Morohashi, 2002). The focus of the development projects was to increase community participation through utilizing the local knowledge available. One such project dealt with beekeepers in rural Indonesia.

The traditional style of beekeeping in Indonesia uses split trees hives that are hollowed and hung in trees, very similar to Kenyan beekeeping practices. The *best practices* development approach analyzed various aspects of traditional beekeeping that were problematic, and made suggestions for improvements in these practices (Table 1).

Table 1: Techniques for improved *tikung* beekeeping and better honey and beeswax yields (Boyen & Morohashi, 2002).

Common practice in the project	**Problems with the practice**	**Suggested improvement**	**Advantage**
1. Honeycombs are collected at night when bees are most docile.	- Bees need daylight to navigate - Night harvesting results in bees losing their orientation - Remaining bees scatter and do not build new combs or produce more honey.	- Daytime harvesting in combination with 'selective cutting' (see #3) allows bees to navigate and return to comb to produce more honey	- Lower bee mortality during harvest - Increased sustainability of bee colonies
2. Bees are driven from their combs by smoke from torches with exposed, smouldering embers	- Many bees are burned and die - Forest fire is a potential hazard	- Hand-held 'smokers' can be used to ward off bees without exposing them directly to burning embers	- Lower bee mortality - Reduced risk of forest fire.
3. Honeycomes are harvested only once per season	-Potential harvest is not achieved. -Full financial value of wax and honey is lost	- Selected cutting of only the honey portion of the comb (leaving the brood intact) would permit 2-3 harvests per season	- Larger honey harvest. - More income for the community. -Greater incentive to protect the forest

The best practices project did not attempt to introduce an entirely new technology or system of management. Conversely, the work was driven by a respect and appreciation of the traditional system and the environmentally sustainable advantages they offered to beekeepers. The best practices approach to development views traditional practices as assets, which in turn

validates the beliefs and ideas of the local people and fosters a sense of ownership and pride. This is crucial to sustainability, because long-lasting development must ultimately be supported by the efforts and enthusiasm of local communities (Ghai & Vivian, 1992).

The intervention also facilitated the exchange of knowledge and ideas across communities by taking Indonesian beekeepers to Vietnam, where similar improvements to the traditional practice have already been embraced. Through this 'farmer-to-farmer' exchange, the Indonesians were able to see first hand how other beekeepers of similar socioeconomic status were able to increase honey yields without making drastic changes in their management. Studies have shown that when farmers about a new innovation from a fellow farmer they more likely to adopt the new practice. A report from the Conference of International Agricultural Research for Development reveals the nature of this insider's perspective. The study interviewed Ethiopian farmers attending a local exhibition that featured farming innovations of both Western and local origin. The farmers were very interested in the source of each technology, as a measure of assessing how feasible it would be for them to implement on their own. Overall, farmers reported having greater confidence in technologies that were developed and endorsed by fellow farmers, as opposed to those developed by expert scientists (Araya, 2007). These findings reiterate the wise use of 'farmer to farmer' interaction to facilitate the adoption of new practices.

The Indonesian best practices project yielded positive results among the beekeepers by improving the overall quality and quantity of their products. Beekeepers reported a 75% increase in honey production, and a 50% increase in wax production (Boven & Morohashi, 2002). Overall the improvements adopted by beekeepers enabled them to generate ten-times more income from honey production than they previously were able to. It must be noted here that the best practices approach to development is still concerned with the economic benefits to be

realized from beekeeping. However, the overarching goal does not seek to maximize production and profit at the expense of the environment, local culture, or honeybee health.

2.) The Kapkuikui Super Log Hive

In the Baringo District of Kenya, beekeepers were asking their government for support. Despite fifty years of government efforts to improve beekeeping technology, the region still showed low rates of modern hive adoption (refer to Gichora case study in Section 3). In an effort to increase innovation diffusion, the Kenyan Agricultural Research Institute (KARI) developed the Agricultural Technology and Information Response Initiative (ATIRI). ATIRI initiated a study to assess the status of Langstroth, Kenyan Top Bar, and log hives among beekeepers, and determine the best hive for arid climate beekeeping. The study observed two groups of beekeepers, and recorded data on "hive occupation, honey production, honey quality, costs of installation and inspection of hives, costs of harvesting, acceptability of the hives by farmers, and ease of management of the apiaries" (Mulindo, et al., n.d.). The overall findings showed that while the KTBH and Langstroth hives yielded a better quantity and quality of honey than the log hive (12, 10, and 8 kg/harvest respectively), the log hive showed an exceedingly greater occupancy rate of nearly 80% (KTBH showed 40%, and Langstroth 30%).

The conclusion of the study was that each hive possessed desirable characteristics for beekeepers. While efficient and clean honey production is often the gold standard for most beekeepers, ATIRI acknowledged the fact that a low hive occupancy rate negates the benefits of managed harvesting and production. Thus, the next step in the research process was to develop a hive that integrated the benefits of each hive. The result of this collaborative process was the 'Kapkuikui Super Log Hive' (KSLH). The new, three-way hybrid hive integrates the preferable

living conditions of the log hive with a grooved interior to encourage a straight comb-formation, which is more manageable for beekeepers. The hive is still a fixed-comb design, but allows for more selective comb harvesting, thus improving the quality and quantity of honey, and also preserving bee brood. The new hive was tested under the same conditions of the original study and yielded 18 kg/harvest with a 75% occupancy rate, proving to be the superior hive design. KARI advertises the hive in their beekeeping guide as one that "combines modern and traditional technology" (Cheng'ole, 2008).

Carving grooves around the inside of a log hive is not a novel practice in the beekeeping world. Many Sub-Saharan African beekeepers have realized the benefits of being able to selectively cut comb without destroying the brood (Crane, 1999). The grooved modification is simple, and doesn't alter the construction materials, methods of beekeeping, or cost. Also, it still allows the bees to construct natural comb in their preferred hive structure. The efficiency created comes from within the preexisting system, rather than being forced from the outside. The use of indigenous knowledge in this research and development project lead to a superior hive design that both the researchers and the farmers could be proud of.

3.) Improved Harvesting and Processing in Zambia

North Western Bee Products (NWBP), a UK-based company and importer of Zambian honey, built its successful business model from a development project that was founded with respect for indigenous practices. Funded by the Zambian government and a German NGO, the initial project sought to increase rural incomes via beekeeping. The first decision of the project leader, David Wainwright, was to determine what type of technology should be used. Wainwright immediately recognized the trend of using modern hives for development work. Yet

he questioned the likelihood that a hive that promises potential for greater production would be successful for small-scale Zambian beekeepers. This lead Wainwright to realize the benefits that the Zambian bark or log hive offered: easy construction, made from local materials, and the flexibility they offer beekeepers to engage in other activities.

The project focus was to create new market opportunities for honey producers, but before they could tackle market demands, the quality of honey needed to be improved. As is common in most of East Africa, the harvested honey is often used to brew local beer. The honey preferred for this fermented beverage contains the bee brood, pollen, and even dead bees. However, this quality of honey would be unacceptable for market sale. Instead of changing their husbandry, the project focused on teaching selective harvesting methods that would ensure clean honey. In addition, the previous methods of processing of honey were inefficient and slow, so the project encouraged beekeepers to take their own initiative in designing and constructing new presses and draining systems.

The result of these initiatives was a honey product that NWBP was proud to purchase and sell. Further initiatives were taken to strengthen local beekeeping networks and market opportunities, however for the purposes of understanding the integration of indigenous knowledge the details of these aspects are not necessary. This case study serves as an excellent example of a Western organization approaching development from an indigenous-inclusive perspective. The project, while still focused on improving the economic situation of rural farmers, was able to avoid altering traditional husbandry practices. The continued use of log hives allowed farmers to remain autonomous and retain a sense of cultural ownership of their product, which contributed to the long-term success of NWBP. Ultimately, the honey producers

expanded into international markets, all the while maintaining their traditional beekeeping practices.

Analysis

The purpose of these case studies is to provide anecdotal data that demonstrates the successful integration of indigenous knowledge in beekeeping projects. Each example differed in the origin of intervention – case study one shows the intervention of a non-profit organization, number two that of a government research initiative, and number three shows the efforts of a private venture. A common thread among the three development cases lies in their utilization of traditional technology and knowledge, with only minor interferences in management practices. In each case study we see the hegemonic view of modern technology's superiority being overturned by an indigenous-inclusive perspective.

In the case of Indonesian beekeepers, the development strategy was intentionally named 'best practices' so as to recognize the superiority of local beekeeping practices. It is through this lens that the development work ensued, placing farmers and locals as integral pieces to the puzzle. Similarly, the Kapkuikui Super Log Hive was born from a government-sponsored project that remained focused on a goal – to definitively determine which style hive is best, without the expectation of a specific outcome. The flexibility of their research enabled extension workers to collaborate with farmers to develop an entirely new hive, an outcome that was not originally part of their plan. The case study of NWBP serves to stand in contrast to the common approach of most private development organizations seeking to expand honey production to foreign markets. Reflecting back on the examples provided in Section Three, organizations like Honey Care Africa and African Beekeepers Limited address honey quality improvement by requiring farmers

to use modern technology. NWBP was able to establish strong partnerships with local beekeepers by respecting their traditional practices, and addressed issues of honey quality through the introduction of careful harvesting techniques. This minor educational service enabled beekeepers to diversify their honey market from local beer brewers to international consumers.

The current reality of beekeeping extension and development in Kenya is one driven by exogenous knowledge and information. This is partly responsible for the ineffective and misguided efforts of extension agents, one of the most commonly cited problems for Kenyan beekeepers (Gichora, 2003). In the eyes of extensionists, there is a large gap between the knowledge that exists in communities, and the Western knowledge that is being imported. This gap is cast in a negative light, leading many to believe that this knowledge gap must be closed. However, pointing out the disparity of knowledge in this way places Kenyan beekeepers in a highly dependent, and inferior position. Development that is achieved through dependencies and hierarchical relationships is neither just nor sustainable.

In order to establish more productive and sustainable relationships with local beekeepers, outsiders with a desire to 'help' must begin to reframe the aforementioned gap in knowledge and recognize the value that traditional knowledge holds. Because IK is endogenous in nature, in that it originates from *within* a community, the integration of such knowledge creates a strong sense of community ownership, which in turn encourages participation among members of the community. Many scholars of community development concur in their assertion that creating a sense of ownership is vital to the success and sustainability of development work (Warburton, 1998; Ghai & Vivian, 1992). As was the case in each of the previous examples of apiculture projects, farmer participation and integration was a key component of the development model, thus establishing a sense of project ownership.

Marrying the knowledge of traditional and modern beekeepers will lead to a more diverse, multi-layered approach to future pursuits of beekeeping. From the viewpoint of pursuing environmentally conscious development, indigenous knowledge offers valuable insight regarding the behaviors and instincts of African honeybees, and shows us how human systems can adapt to function in harmony with honeybees, recognizing the relationship as a dynamic aspect of a greater ecosystem. As described by Eleanor Fisher of Bees for Development, the appreciation of indigenous beekeeping allows us to see "the nature of people's relationships, their knowledge, and how they experience and give meaning to beekeeping in their lives" (Fisher, 2002). In this way, IK is also valuable for providing a social and cultural context to development efforts, situating local people as owners and co-creators of their own progress and change.

SECTION 6: DRAWING CONCLUSIONS & MOVING FORWARD

Looking back, this discussion of beekeeping as a means of improving human wellbeing began with the idea of development. By definition, development is anthropocentric in nature: inspired by humans for the benefit of humans. Ultimately, all development work comes down to inciting change, hopefully for the betterment of society. This is based on the assumption that humans know what is best for ourselves and for each other. However, if there is one thing that history has taught us, it is that over time, we tend to prove ourselves wrong. And it is when we fail to make space in our lives to be wrong that we will fail to think differently from how we do today, getting stuck in patterns of thought and action, perhaps without even realizing it. The inflexible nature of the human mind can manifest itself on an individual level, and a societal level. This path dependency, or the pattern of repeatedly making the same decisions following the same logic, is an inherent facet of human nature. The path dependency of development work over the years has been to focus our attention on the human condition through a scientific lens. As a result, we fail to see how our well-intentioned actions may be contributing to our strife through ecological and biological damage. In addition, we have become blind to the other, non science-based realities, and different ways of understanding and approaching the problems that we face.

My hope is that through an alternative exploration of beekeeping and development in Kenya, we can begin to pull ourselves out of the path dependent trajectory of beekeeping that we seem to be so deeply entrenched in. Recognizing the connection between sustainable beekeeping, indigenous knowledge, and the prosperity of human kind is not necessarily obvious, nor is it an absolute observation. It may be a reality to some economists, extension officials, and even Kenyan beekeepers that we stand to benefit from the use of modern technology. Similarly, it is

also a reality that some aspects of modern science and technology will ultimately help create a safer, cleaner, and healthier planet and population. However, my goal is to convey a more powerful and present reality, one in which the deteriorating state of honeybee health provides a clear and irrefutable barometer of the overall health of our ecosystems. In this reality the pollinators of the earth and the ecosystems that depend on them are given precedence, and the knowledge that drives human action is a reflection of our interconnection and interdependence with honeybees, and with each other.

Government Policy and Development: The Precautionary Principle

For as many opportunities as beekeeping technology has created, it has simultaneously presented beekeepers with even more challenges and risks. It is clear to see how we have benefitted from technological advancements in beekeeping, namely in the abundance of honey that is produced worldwide, and the increased agricultural productivity induced by honeybee pollination. However, there remains a great deal of uncertainty in surrounding the devastating environmental and ethical problems that arose as a result of improved apiculture technology and management. This uncertainty is manifested in the decline of honeybee health worldwide, for which a definitive cause has yet to be proven by science. Included in the list of factors under scrutiny are the conventional management practices of modern beekeeping, and the troubling presence of the Varroa mite (Frazier et al., 2009). However, when faced with scientific uncertainty surrounding a modern technology, it can be difficult to know just how society should move forward. Is it better to embrace the potential for technological progress and turn a blind eye to the uncertain risks? Or do we proceed with caution, and heed to the message that is being sent

by unhealthy bees? To answer this question, I propose that we look to the precautionary principle for guidance.

The 'precautionary principle' seeks to guide humans in their decisions regarding the wise and responsible use of technological innovation (UNESCO, 2005). It is rooted in the belief that prevention is better than cure, and that if we are uncertain of anticipated risks, it is better to abstain from the activity altogether. The principle does not call upon scientific evidence to justify precaution. As outlined by Article 15 of the Rio Declaration on Environment and Development, the precautionary principle states that "where there are threats of serious and irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation" (UNEP, 1992) In other words, new technologies should not be treated as 'harmless until proven harmful', and scientific uncertainty is no excuse for inaction. Precaution dictates that we must not treat our earth as a laboratory to test every new and exciting innovation that holds promise for an improved human existence. From an economical standpoint, the precautionary principle can be justified by the fact that it is better to deal with ecological damage in the initial stage before it gets worse. If left unaddressed, environmental degradation can lead to exorbitant costs, or even worse, irreversible damage (Dryzek, 2005).

In 2005 the precautionary principle was jointly adopted by the United Nations Educational, Scientific, and Cultural Organization (UNESCO) and the World Commission on the Ethics of Scientific Knowledge and Technology (COMEST). They suggested it be used as a 'policy guide' for considering the environmental and ethical implications of innovative science and technology (UNESCO, 2005). The principle is often viewed as a core value of sustainable development, and further reiterates the importance of acting with environmental concern.

Moving forward, it is imperative that we act with this theory in mind, by taking precaution where it was not taken in the past. This is what some may refer to as 'learning from our mistakes'. Even if we don't know what our mistakes were, it is more responsible and ethical to take *precaution* and avoid the risk of making them again. Looking back to the discussion of technology transfer and innovation diffusion in Kenya, it seems clear that these efforts are being made with little regard for the precautionary principle. We have no evidence to definitively say whether the husbandry practices used to manage the Langstroth or Kenyan Top Bar Hives are harmful to the African honeybee. Yet does an absence of knowledge justify continuing down an uncharted and potentially risky path?

Kenya stands in a unique place to be a leader of sustainable beekeeping promotion. The government is one of the primary sources of extension and on site education for emerging beekeepers and beekeeping cooperatives. The influence these extension personnel carry is not to be underestimated, nor underutilized. As we have seen, the Kenyan government is a staunch supporter of modern hive adoption, despite unimpressive results. In moving forward, the Kenyan government must take heed in their decisions regarding the use of technology that may be unsuitable for beekeepers and the bees themselves. Following the suggestion of UNESCO, government policy and extension efforts would be well advised to exercise the precautionary principle in their decisions regarding further beekeeping development.

While the precautionary principles can be applied to address our fragile relationship with honeybees and the environment, we must not forget about our interactions with one another. Even if we, as western individuals with a genuine interest in helping Kenyan people and honeybees, can unanimously agree that sustainable practices guided by precaution should inform our actions, we must still be sensitive to the manner in which we proceed with this work. The

following section will address the way we approach development projects, with specific regard to our attitudes, perceptions, and views about ourselves and each other.

Linking Environmental Sustainability and Indigenous Knowledge

The perspective presented here draws upon the philosophies of deep ecology, a movement that seeks to bring about positive change in humanity through transforming the way people experience and connect with the world around them. Deep ecologists are concerned with two main principles: self-realization, and biocentric equality. Self-realization refers to acknowledging the interdependent role of humans as a small part of the larger whole. It is the awareness of the 'organic unity' that connects our species, populations, and ecosystems. Biocentric equality seeks to counter anthropocentric superiority, by giving the same rights to all living things, be it an animal, insect, or plant (Deval and Sessions, 1985). The broader movement of environmental consciousness seeks to dismantle the preconception that human beings hold a superior place in a hierarchical world (Dryzek, 2005). From the perspective of deep ecology, humans have a responsibility to be aware of how our interactions with the honeybee affect their population health and wellbeing. As we seek to bring equality among our own species, we cannot overlook the equality and respect that *Apis mellifera* deserves as well.

One of the key critiques of environmental consciousness and deep ecology is that it depends on rhetoric and argument to change the way people think and relate to their environment. Preaching to others that they should think something different is only sometimes effective, but is a near impossible feat within the structure of our capitalist political economy (Ibid, 2005). This is where indigenous knowledge can play an important role. I believe that

indigenous knowledge can serve as an avenue for translating and integrating ecological wisdom and equality into our current system of thought.

In the context of beekeeping, traditional husbandry practices of Kenya are a product of centuries of a mutually beneficial relationship between humans and honeybees. As discussed, the indigenous technology and beekeeping methods of Kenya mimic and support the biological instincts of African bees, like seasonal absconding, swarming, and small sized colonies. It is unlikely that any Kenyan beekeeper would identify him/herself as a deep ecologist, yet their practices reflect the core principles of self-realization and biocentric equality. In this way, indigenous knowledge and insight holds the potential to be a powerful gateway between the perceived radicalism of deep ecology, and the existing technocratic and scientific view of beekeeping development that currently exists.

The operative word in this argument is *integration* – the aggregation of various perspectives to see more sides of the issue, with the hope that this will result in actions that reflect the interests of all interested parties, honeybees included. Is there a way to pursue beekeeping in Kenya that satisfies the perceived needs of humans, that simultaneously supports a healthy population of African bees? It seems that to answer this question, it would be helpful to have as much input from various actors as possible. In fact, humans thrive on the abundance of data, resources, and information availability. We are a highly information-driven society, and depend upon information to achieve our desired economic and social outcomes (Fischer, 2000). Yet for a society that values information as a resource, we tend to be very selective about the circumstances under which the information came to be. That is to say, we are not always inclusive of all epistemological roots, often privileging the positivist perspective that can be justified by 'reproducible' and 'unbiased' science. What would happen if we attempted to break

down the hierarchical knowledge structure of development work, and bring alternative epistemologies into our field of vision? How might our eyes open to new solutions and approaches to bringing about positive change?

The integration of indigenous beekeeping knowledge holds the potential to foster a new kind of relationship between *Homo sapiens* and *Apis mellifera,* one that is mutually beneficial, and symbiotic in nature. This relationship would rely upon husbandry practices that seek to be pro-health instead of anti-disease, preventative instead of curative, and intuitive rather than manipulative. It would recognize and respect the inter-reliance of man and honeybee, and the ways in which this relationship may differ depending on geographical location and cultural context. However, it is one thing to imagine this kind of future between man and bee, and quite another to actually pursue it. The following section will provide recommendations for moving forward with the 'development' of beekeeping in Kenya, with specific regard to government policy, international development initiatives, and research.

International Development and Research: The Power of Reframing

Integrating the indigenous knowledge of Kenyan beekeepers into international development and research initiatives is certainly easier said than done. To ask this of international and academic institutions is to challenge the certainty, security, and power of scientifically produced knowledge. More specifically, it challenges the value of expert knowledge, the very thing that drives technology-focused development in Kenya. Yet, as previously discussed, indigenous knowledge holds great potential in translating the ecological insights of local people into sustainable beekeeping practices. So, how do we begin the process of allowing alternative types of knowledge to enter the development process? The ability to

reframe ourselves and others might be the best place to start. Through reframing, we can begin to conceptualize an approach to development that also values the indigenous knowledge of local Kenyans.

To avoid the trap of 'expert' titles, hierarchical knowledge, and imbalanced perceptions of power in development work, the ability to *reframe* oneself holds immense power. The idea of reframing refers to the ability to orient oneself from a different perspective; to see oneself and others in a different light; to redefine oneself, figuratively and literally.

The ability to be both conscious and reflexive is central to the reframing process. Consciousness, in the context of development work, connotes the ability of an individual or organization to be aware of the 'outsider' status they carry, and sensitive to the local perceptions and attitudes regarding their presence in the community. Both domestic and international development often results in tension between 'insiders' and 'outsiders', or 'locals' and 'experts'. The local vs. expert dynamic of development projects often results from preconceived notions, misperceptions, and a general lack of communication and understanding. The self-declared 'experts' of apiculture in the United States and Europe all too often wear their title on their sleeve, which can inadvertently create sense of superiority and hierarchy. As a result, local Kenyans become ostracized by their 'lack' of technical expertise, creating an imbalanced relationship of power. This is where reflexivity is important for 'experts' of apiculture, who must realize that in the context of Kenyan beekeeping, their title does not hold the same clout. In addition, local Kenyans have the opportunity to be reflexive of their own role in this process. It is just as important that Kenyans do not assume that all technology from the west is necessarily better than their own.

An advocate of reframing in the classroom, Brazilian philosopher Paulo Freire proposed that when relationships defined by "the teacher-of-the-students and students-of-the-teacher cease to exist… a new term emerges: teacher-student with students-teachers" (Freire, 1970). This reframing implies that teachers and students are simultaneously playing both roles, teaching each other, and learning from one another. Freire believed that in redefining the roles of teacher and student in word, therein begins the process of thinking about the roles differently. Reframing not only implies a shift in perspective, but also a widening as well. Applying Freire's theory to the expert/local dynamic of development work, we see that both parties can play both roles as well. Locals can be reframed, and redefined, as *local-experts* – experts of their community, environment, culture, and beekeeping practices that are most appropriate in their own context. The new title of *local-expert* orients Kenyan beekeepers as owners of valuable knowledge – that of an expert. Simply acknowledging this fact holds the potential to shift the balance of power and authority more towards the center, facilitating equal partnerships rooted in mutual respect. And with respect for one another follows understanding, communication, and collaboration, the keystones of successful and lasting development.

Conclusion

From what surely began with modest roots over two million years ago, the relationship between man and honeybee has now evolved into an international, industrial, technocratic web of socially, environmentally, and economically complex interdependencies and problems. This thesis shone a light on the interconnection of mankind's efforts to bring positive change through beekeeping development, and the consequences incurred by honeybees as a result. The devastation that industrialized, commoditized apiculture has caused is no longer an uncertainty;

it is a reality witnessed by disappearing honeybees worldwide. With this knowledge in hand, it is our moral obligation to pursue a future for mankind that is guided by more than just a desire to improve our own wellbeing, but also that of honeybees, and the ecosystems that cradle us both.

In Kenya, the opportunity exists to steer the relationship between man and honeybee in this very direction – the direction of environmental and social sustainability. Implied in the word 'sustainable', this trajectory would leave humans and honeybees in a state of health, vitality, and symbiosis for centuries to come. Decisions that hold the potential to affect honeybees would be made with precaution, and with a critical consciousness of the interdependency that exists between man and environment. It is through the deeply nuanced and insightful wisdom of indigenous peoples that we can transform theory into practice, and contextualize a more sustainable approach to beekeeping development in Kenya. Integrating indigenous beekeeping knowledge into current development and research initiatives is dependent upon our ability to foster relationships of mutual respect, where multiple perspectives and sources of knowledge carry equal value. With this diversity of knowledge in hand, we will be better equipped to move forward in the pursuit of a more healthy and prosperous future for humans, and honeybees too.

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